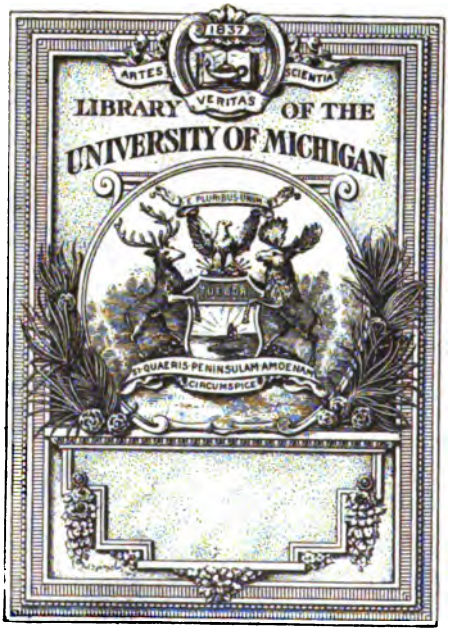
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THE
GEOGRAPHY OF MAMMALS

YOUNG FEMALE GORILLA

(From an animal living in the Gardens of the Zoological Society of London, 1896.)

[Garden-Guide, 1896.]

THE

GEOGRAPHY OF MAMMALS

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"Benedicite omnes bestiæ et pecora Domino: laudate et superexaltate eum in sæcula."

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PREFACE

THE first seven chapters of this volume were written by my son, Mr. W. L. Sclater, and published in *The Geographical Journal* (1894–97). They are now reprinted here, with some slight alterations, by the kind permission of the Council of the Royal Geographical Society. The eighth chapter, on Marine Mammals, was read by me as a paper at a meeting of the Zoological Society of London on March 16, 1897, and was subsequently published in the Society's *Proceedings*. It is reproduced here, with slight alterations, by the kind permission of that Society. The remaining chapters of this volume, in which the distribution of Mammals is treated of systematically, have been prepared by me specially for the present work.

Of the fifty illustrations contained in the text, which have been selected to show some of the chief Mammals typical of the different Regions, forty have been drawn by Mr. J. Smit specially for the present work. Of the remaining ten, five have been kindly lent to us by the Zoological Society of London

and five by Messrs. Adam and Charles Black, the publishers of Flower and Lydekker's standard work on Mammals.

It is hoped that most of the leading facts and the conclusions to be drawn therefrom as to the distribution of existing Mammals have been correctly stated in the course of this work, and that it may be of some use to students of this most attractive branch of Zoology. At the same time, it should be recollected that science in all its branches moves fast nowadays, and that statements which are perfectly correct one day may be falsified at any moment by new discoveries and by fresh investigations.

I must not conclude these remarks without offering our best thanks to Mr. W. E. de Winton, F.Z.S., and Mr. F. E. Beddard, F.R.S., F.Z.S., for their kind assistance in the compilation of the Tables of Genera, and in the correction of the proofs of this volume.

P. L. SCLATER.

3 Hanover Square, London, W.,
March 1, 1899.

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CHAPTER I

INTRODUCTION

(PLATE I., p. 16)

IT has long been evident to naturalists that the ordinary political divisions of the earth's surface do not correspond with those based on the geographical distribution of animal life. Europe, for instance, the most important of all the continents politically speaking, is for zoological geographers, as well as for physical, but a small fragment of Asia. Again, the strip of Africa which borders the Mediterranean and extends to the Sahara agrees closely, as regards its animal life, with Europe, and is altogether different from the great mass of the African continent. Proceeding to America we find that physical geographers, as well as political, divide the two great masses of the New World at Panama. But those who study distribution have ascertained that Central America and Southern Mexico belong zoologically to South America, and they are consequently obliged to place the line of demarcation much further north.

Let us, therefore, dismiss from our minds for the moment the ordinary notions of both physical and political

geography, and consider how the earth's surface may be most naturally divided into Primary Regions, taking the amount of similarity and dissimilarity of animal life as our sole guide. In order to endeavour to solve this problem, let us select the mammals, as the most highly organised and altogether the best-known group of the animal kingdom, and examine the geographical distribution of this class of animals over the world's surface.

Mammals are divided by naturalists into eleven large groups, called "Orders." As regards their distribution, however, these Orders fall into two very different categories, according as they live on land or in the water—terrestrial and marine. For out of the eleven Orders, one of the principal divisions of the Carnivora—the Pinnipeds or seals, and two other Orders in their entirety—(the Cetaceans or whales, and the Sirenians or Manatees) are specially adapted for existence in water. Land is, therefore, a barrier to their extension, whereas, on the contrary, in the case of the ordinary terrestrial mammals, land is the means by which they extend their ranges, and seas and rivers form their restraining boundaries.

We will for the present put aside the marine mammals, and address ourselves to the discussion of the distribution of the nine terrestrial Orders, namely:—

1. Primates.
2. Chiroptera.
3. Insectivora.
4. Carnivora.
5. Rodentia.
6. Ungulata.
7. Edentata.
8. Marsupialia.
9. Monotremata.

Now, as is generally agreed by naturalists, one of the most certain and best ascertained points in the classification of mammals is, that these nine Orders can be grouped

primarily in three natural divisions (which may, in fact, be considered as Sub-classes) of nearly equal value. These three Sub-classes are, as named by Professor Huxley—the *Prototheria*, embracing only the Order Monotremata—the *Metatheria*, equivalent to the Order Marsupialia, and the *Eutheria*, which includes all the remaining Orders from the Edentata to the Primates. Let us, therefore, consider the distribution of the members of these three Sub-classes on the earth's surface. When we come to examine the ranges of these groups on the map, we shall find that the Monotremes are wholly confined to Australia and New Guinea; that the Marsupials predominate in Australia, and are only met with elsewhere in South America (one or two species of Opossum occurring in North America, but being probably only recent intruders from the south); and that the typical mammals or *Eutheria* occupy the rest of the world.

Again, after examining the distribution of the seven Orders of typical mammals, we remark the following significant facts:—

1. The absence of Insectivores in South America.

2. The great prevalence of Edentates in the same country; the Sloths, Armadilloes, and Ant-eaters, constituting three out of the five known families of this Order, being entirely confined to South and Central America.

Taking these main facts as our guide, we may divide the land-surface of the Earth as follows, into three divisions:—

(1) Land where Marsupials prevail; no Eutherians except Rodents and Bats; Monotremes . .	Australia, New Guinea and the adjacent islands.	*Notogæa.*

(2) Land where Eutherians and Marsupials occur; no Insectivores; many Edentates; no Monotremes . .	America south of the Isthmus of Tehuantepec.	*Neogæa.*
(3) Land where Eutherians only occur; few Edentates, no Marsupials[1] nor Monotremes . .	Europe, Asia, Africa, Asiatic Islands down to Wallace's line, and North America down to the Isthmus of Tehuantepec.	*Arctogæa.*

The fault of this division is that it leaves the great mass of land in the Northern Hemisphere undivided and rather unmanageable. But this northern land is easily separable into four sections, although it should be understood that these four sections are not of equivalent value to the two other primary divisions. Thus we obtain a division of the land-area of the globe for mammals into six areas, which are called Regions (see Plate I., p. 16), and which may be shortly defined and named as follows:—

NOTOGÆA.	Australia, New Guinea, and adjacent islands up to Wallace's line . .	I. *Australian Region.*
NEOGÆA.	Central America south of the Isthmus of Tehuantepec, the West Indies, and South America	II. *Neotropical Region.*
ARCTOGÆA.	Africa south of the Atlas, and Madagascar	III. *Ethiopian Region.*
	South Asia, the Philippines and Islands of the Indian Archipelago down to Wallace's line, and Celebes . . .	IV. *Oriental Region.*

[1] As will be shown later on, this statement is not absolutely correct as regards North America, as at least *one* species of marsupial occurs within its limits.

ARCTOGÆA (*continued.*)	North America down to the Isthmus of Tehuantepec	V. *Nearctic Region.*
	Europe, Africa north of the Atlas, and Northern Asia	VI. *Palæarctic Region.*

We will now take a brief survey of the principal features of these six regions—as shown in the accompanying chart (Plate I., p. 16) and their most characteristic mammal-forms.

1.—Australian Region

Extent.—Australia, New Guinea, and Moluccas up to Wallace's line, New Zealand, and the numerous islands of the Pacific.

Characteristics.—Absence of nearly all Eutherian Mammals, except a few Rodents and Bats; presence of six distinct families of Marsupials with one hundred species, and the only two known forms of Monotremes.

2.—Neotropical Region

Name.—*νεὸς*, new, and *τρόπικος*, *i.e.*, tropical land of the New World.

Extent.—America, south of the Isthmus of Tehuantepec, and the West Indies.

Characteristics.—Monkeys of the peculiar families *Cebidæ* and *Hapalidæ;* absence of Frugivorous Bats, and presence of Vampires (*Phyllostomatidæ*); abundance of the Porcupine family; absence of Insectivores and Civets, also of Elephants; presence of Tapirs; no Ruminants except Deer and Lamas; presence of Sloths, Ant-eaters, and Armadilloes; one family of Marsupials—Opossums.

3.—Ethiopian Region

Name.—*Αἰθίοπες*, ancient name for negroes.

Extent.—Africa, south of the Atlas; Arabia up to the Persian Gulf, and Madagascar.

Characteristics. — Chimpanzee and other Monkeys; absence of Bears and Deer; presence of Lion, African Elephant, Hyrax, Rhinoceros, Hippopotamus, Wart-hog, numerous Antelopes, Giraffe, Pangolin, Ant-bear—general richness in large and highly-organised Ungulates.

4.—Oriental Region

Extent.—Southern Asia, south of the Palæarctic Region, and islands of Indian Archipelago down to Wallace's line, including Celebes.

Characteristics.—Orangs, Gibbons, and other peculiar Monkeys. Flying Lemur, Tiger, and other cats, Indian Elephant, Rhinoceros, Malayan Tapir, Manis.

Generally, it may be said that the peculiar forms of the Oriental Region are fewer than in the Ethiopian Region, and that the Oriental Region has Bears, Deer, and Tapirs, which are wanting in the latter.

5.—Nearctic Region

Name.—*νεὸς*, new, and *ἄρκτος*, north, *i.e.*, northern district of the New World.

Extent.—North America, down to the Isthmus of Tehuantepec.

Characteristics.—General mammal-fauna, very like that of the Palæarctic Region, but mixed up with endemic

forms and intruders from the south. Bears, Beavers, Sheep, and Deer similar; Prong-buck, Pouched Mice, and Musquash peculiar; Raccoon and Opossum, probably derived from the south.

6.—Palæarctic Region

Name.—παλαιὸς, ancient, and ἄρκτος, north, as embracing the whole northern area of the Old World.

Extent.—Whole of the Eastern Hemisphere north of a line on the south of the Atlas, and running eastward through the south of Palestine and Persia, along the Himalayas, through Central Asia and the centre of China to the Pacific.

Characteristics.—Absence of Monkeys, Lemurs, and Frugivorous Bats; abundance of Carnivores—Ounce, Lynxes, Wolves, Foxes, Bears, and Weasels; Rodents—Marmots, Beavers, Pikas; Ungulates — Sheep, Deer, Chamois, and Musk-deer; no Elephants nor Hyrax.

This division of the Earth's surface into six regions was first proposed by one of the authors of the present work in an essay on the distribution of the Class of birds read before the Linnæan Society in 1857 (9). It was further elaborated and upheld in an address given to Section D. of the British Association at the Bristol Meeting in 1875 (10), and in a Paper published in *The Ibis* in 1891 (11). The same system was adopted by Mr. Wallace in his standard work on "Geographical Distribution" (13), and was there shown to be applicable to the other principal groups of terrestrial animals. Moreover, the names then bestowed on the six great primary Regions are now in general use among naturalists in all countries. Mr.

Wallace, who has devoted many pages to the discussion of this subject,[1] has come to the conclusion that, admitting that these six regions are not precisely equal in rank, and that some of them are more isolated than the others, they are in geographical equality, compactness of area, and facility of definition beyond all comparison better than any others which have been suggested for the purpose of facilitating the study of geographical distribution.

Notwithstanding Mr. Wallace's strong support, however, it is right to say that this system has not been universally accepted. Professor Huxley (6) in 1868 proposed to separate the world into two divisions—Arctogæa and Notogæa, the former containing the Nearctic, Palæarctic, Ethiopian, and Oriental Regions, and the latter the Neotropical and Australian Regions. He adopted the Nearctic, Palæarctic, Ethiopian, and Oriental Regions as subdivisions of Arctogæa, and only stipulated for the formation of a Circum-polar province independent of the Nearctic and Palæarctic Regions. Notogæa Professor Huxley divided into three provinces (*a*) the Austro-Columbian (=the Neotropical), (*b*) the Australian (=the Australian Region minus New Zealand), and (*c*) the New Zealand province.

From this it will be seen that Professor Huxley's scheme does not really diverge materially from the system here employed; the chief points of difference being (*a*) the uniting together of the Australian and Neotropical Regions into Notogæa; (*b*) the formation of independent Circum-polar and New Zealand provinces. With regard to the first point, almost the only bond of union between the Australian and Neotropical Regions, so far as mammals, at any rate, are concerned, is the presence of Marsupials

[1] "Geographical Distribution of Animals," vol. i., chap. iv.

in both regions. But the Marsupials of Australia seem to have but a very remote connection with those of South America, and there is at present no palæontological evidence of the former occurrence of the Australian forms, or of forms allied to them, outside of Australia itself.[1] On the other hand, the presence of fossil opossums (*Didelphyidæ*) in the Eocene beds of France, shows that the South American forms were formerly more widely spread.

Professor Huxley has also cited the Parrots (*Psittacomorphæ*) "as helping, together with the three-toed *Ratitæ*, to bind together the widely-separated portions of the south world." But on referring to the account of the distribution of the Parrots in Salvadori's recently published catalogue (8), it will be found that out of the six families into which he divides the group, five are practically confined to the Australian Region, and that the remaining one is widely spread throughout the tropical regions of both hemispheres. The most recent arrangement of this family, therefore, gives little support to Professor Huxley's arguments.

Looking, again, to the distribution of the *Ratitæ* (wingless birds), we find the Neotropical form (the Rhea) more closely connected with the Ostrich, the Ethiopian form, and that they both differ considerably from the Emus, Cassowaries, and Kiwis, the three Australian representatives of this order. Thus, then, there seems to be

[1] Recently Señor Ameghino has described from the Santa Cruz beds of Patagonia, which are probably of Eocene age, certain fossil mammals which he has referred to the *Dasyuridæ*, one of the Australian families. Again, Mr. Thomas' *Cœnolestes* (see *P. Z. S.* 1895), is also believed to be allied to the Australian Diprotodonts. If these relationships should turn out to be correct, it will indicate further evidence of some connection between South America and Australia, though at a considerably remote epoch of geological time.

scarcely any ground for connecting the Neotropical and Australian Regions under one name.

Before discussing the other differences between this scheme and that of Huxley, it will be as well to mention the diverging views of some other naturalists. Of these the chief is Professor Heilprin, of Philadelphia, who in his "Geographical and Geological Distribution of Animals," (5) "in accordance with a suggestion by Professor Newton," has proposed to unite the Nearctic and Palæarctic Regions into a single realm—the "Holarctic"—and to separate the Pacific Islands from Australia as the "Polynesian Realm." Again, Mr. J. A. Allen, of New York, in his recently published essays (1 and 2), has shown considerable independence of thought in this matter. In the introduction to the later of them, which deals chiefly with the distribution of North American mammals, Mr. Allen gives an account of the influences which, in his opinion, mainly determine the geographical distribution of life, dwelling first on the great importance of temperature and moisture, and afterwards on the inter-relation of land-areas, which, he says, is "co-eval and perhaps more than co-ordinate with climate in its influence upon the distribution of life." Next, Mr. Allen treats of the seven primary life-regions, or "realms" as he terms them, into which he proposes to divide the Earth. These are:—

1. *An Arctic Realm*, occupying all the country in both hemispheres north of the isotherm 32° F., this boundary corresponding very closely to that of the northern limit of trees.

2. *A North Temperate Realm*, occupying the whole of the northern hemisphere between the isotherms of 32° and 70° F.

3. *An American Tropical Realm*, consisting of Tropical America.

4. *An Indo-African Realm*, consisting of Africa, except the northern border, and Tropical Asia and its islands.

5. *A South American Temperate Realm*, embracing extra-tropical South America.

6. *An Australian Realm*, equivalent to our Australian Region.

7. *A Lemurian Realm*, containing Madagascar and its islands.

Mr. Allen's views on Distribution have been criticised and answered by another American naturalist, Mr. Gill (4), who has proposed a division of the Earth into nine "realms." These, as will be seen, although not differing in many cases from regions adopted by former authorities, are distinguished by an entirely new set of names, as follows:—

(1) The Anglo-gæan (=Nearctic Region).

(2) The Eury-gæan (=Palæarctic Region).

(3) The Indo-gæan (=Oriental Region).

(4) The Afro-gæan (=Ethiopian Region).

(5) The Dendro-gæan (=the tropical half of the Neotropical Region).

(6) The Amphi-gæan (=the temperate half of the Neotropical Region).

(7) The Austro-gæan (=Australia, New Guinea, and the adjacent islands).

(8) The Ornitho-gæan (=New Zealand).

(9) The Neso-gæan (=Polynesia).

Dr. Bowdler Sharpe (12) has also recently published his views on the zoo-geographical areas, as worked out from the distribution of birds. Dealing here only with the division of the Earth into Regions, we notice that

although he makes many complimentary allusions to Mr. Allen and his views, he employs in nearly all its entirety the system adopted in this work, with the exception that he recognises an Arctic Sub-region to include the more northerly parts of both the Old and New worlds.

Finally, Professor Newton, who has given us his views on this subject as regards birds (7), adopts the method of divisions followed here with the two following exceptions. In conformity with the suggestion already made to Professor Heilprin, he unites the Palæarctic and Nearctic Regions under the title "Holarctic," and he also separates New Zealand from Australia as an independent region.

The chief questions in dispute, therefore, seem to be as follows:—

(1) Whether the Palæarctic and Nearctic Regions are to be recognised as separate?

(2) Whether Madagascar and New Zealand are to be separated as independent regions from the Ethiopian and Australian Regions respectively?

(3) Whether the Ethiopian and Oriental Regions should be joined to form one region?

(4) Whether there are any good grounds for dividing the Neotropical into two separate regions.

The only way in which questions of this sort could be settled would be by constructing accurate lists of the families and genera of the various classes of the terrestrial faunas of the regions in dispute, and then carefully comparing them, in order to determine the percentage of peculiar species and of absentees. The difficulty of doing this satisfactorily is twofold.

(1) The absence of any definite boundaries to most of

the regions, and hence the difficulty in determining how many of the border-forms, which have obviously intruded from the neighbouring regions, should be counted.

(2) The uncertainty as to the limits of the genera. This uncertainty has been greatly increased of late years by the action of some zoologists in proposing a multitude of unnecessary generic terms.

When these two factors have been settled and the lists constructed, a further difficulty is met with, and this is one which depends very much on the individual fancy of the author, namely, as to the percentage of peculiarity which should be required to constitute a Region.

Taking the first question in dispute, we find that Mr. Allen, in his paper already quoted (2), gives a tabulated list of the genera of his North Temperate realm, dividing them into North American and Eur-asiatic (= Palæarctic) forms, and putting the individual genera into three categories, namely, those circum-polar, or common to the Nearctic and Palæarctic Regions (numbering thirty-two); those peculiar to each Region (*i.e.* twenty-nine to the Nearctic and forty-one to the Palæarctic); and, finally, those which range further south into the Neotropical Region on the one hand, and into the Oriental and Ethiopian Regions on the other.

Working from these tables we find that 38 per cent. of the Nearctic genera and 42 per cent. of the Palæarctic genera are confined to their respective Regions, while 42 per cent. in the case of the Nearctic and 34 per cent. in the case of the Palæarctic are common to the two regions. These last percentages include, however, several quite widespread genera which can hardly be called circum-polar—such as *Sciurus*, *Sciuropterus*, *Lepus*, *Lutra*, *Canis*, and *Felis*.

These figures show that there is, as has indeed never

been disputed, a great amount of similarity between the Nearctic and Palæarctic faunas, but not enough to justify the junction of these two great land-masses into one "Region" or "Realm."

As for the so-called "Arctic realm," which consists of the land bordering the Polar Ocean and Hudson's Bay and the great peninsula of Greenland, "beyond the limit of arboreal vegetation," together with the similar Arctic portion of the old world, Mr. Allen states, no doubt correctly, that it contains a "homogeneous hyperborean fauna of circum-polar distribution." But looking to the extreme poverty of life in these inclement latitudes, as Mr. Allen well puts it, it seems to be quite unnecessary to elevate this wretched fraction of the Earth's surface into one of its principal constituent life-regions. The plan adopted by Mr. Wallace, of regarding it as a borderland between the Nearctic and Palæarctic Regions is far preferable.

The question of the recognition of Madagascar and New Zealand as independent regions will be further discussed in the articles on the Ethiopian and Australian Regions respectively, as will also the propriety of dividing the Neotropical into two separate regions. A few words, however, may be said here with regard to Mr. Allen's proposal to join together the Oriental and Ethiopian Regions into one "Realm."

According to the estimate given below (Table I., p. 16), the total number of genera found in the Oriental Region is 113, and of these thirty-nine are not found elsewhere. Of the balance—seventy-four—eight only are common to the Oriental and Ethiopian Regions, and are not found in any other Region,[1] whereas twenty-eight more, also known

[1] These are *Manis*, *Rhinoceros*, *Elephas*, *Golunda*, *Atherura*, *Viverra*, *Mellivora*, and *Nycteris*.

in the Oriental and Ethiopian Regions, are likewise found in the Palæarctic Region. Furthermore, out of the eight genera above mentioned, although they are not now found in the Palæarctic Region, four of them are known to have existed there during the Pliocene period. This shows, we think, very conclusively that what small resemblance there is between the mammals of the Oriental and Ethiopian Regions is due rather to a similarity in their origin, than to any sort of direct connection between the two regions.

To sum up the subject we add a table of the numbers of orders, families, and genera of mammals found in the six different Regions, together with the number of genera confined to them (endemic), the number of those slightly transgressing the Regional borders (quasi-endemic), and the number of those of wide-spread distribution in each Region. In the second table these numbers have been reduced to percentages, which give in some respects a better idea of the relative specialisation of the mammal-fauna of each Region. On examining these tables, it will be seen that the Ethiopian Region stands second in point of the number of genera confined to it, coming next to the Neotropical Region.

The lists of genera from which this table has been worked out are based on those adopted in Flower and Lydekker's (3) standard work on mammals, with a certain number of additions and corrections. In consequence of this the figures in the case of the Nearctic Region will not be found to exactly correspond with those quoted from Mr. Allen above (2). It must also, of course, be understood that the figures are merely approximate, and liable to continual alterations as new discoveries are made.

Table I.

Approximate Numbers of Families, Genera, and Species of Mammals in the six Regions.

Regions.	Families.				Genera.				Species.
	Endemic.	Quasi-endemic.	Wide-spread.	Total.	Endemic.	Quasi-endemic.	Wide-spread.	Total.	Total.
1. Australian .	7	4	11	22	51	6	27	84	284
2. Neotropical	10	5	13	28	103	15	12	130	501
3. Ethiopian .	10	2	30	42	99	3	48	150	577
4. Oriental .	2	1	33	36	39	10	64	113	557
5. Nearctic .	2	0	20	22	21	2	43	66	192
6. Palæarctic .	0	0	32	32	25	4	74	103	448

Table II.

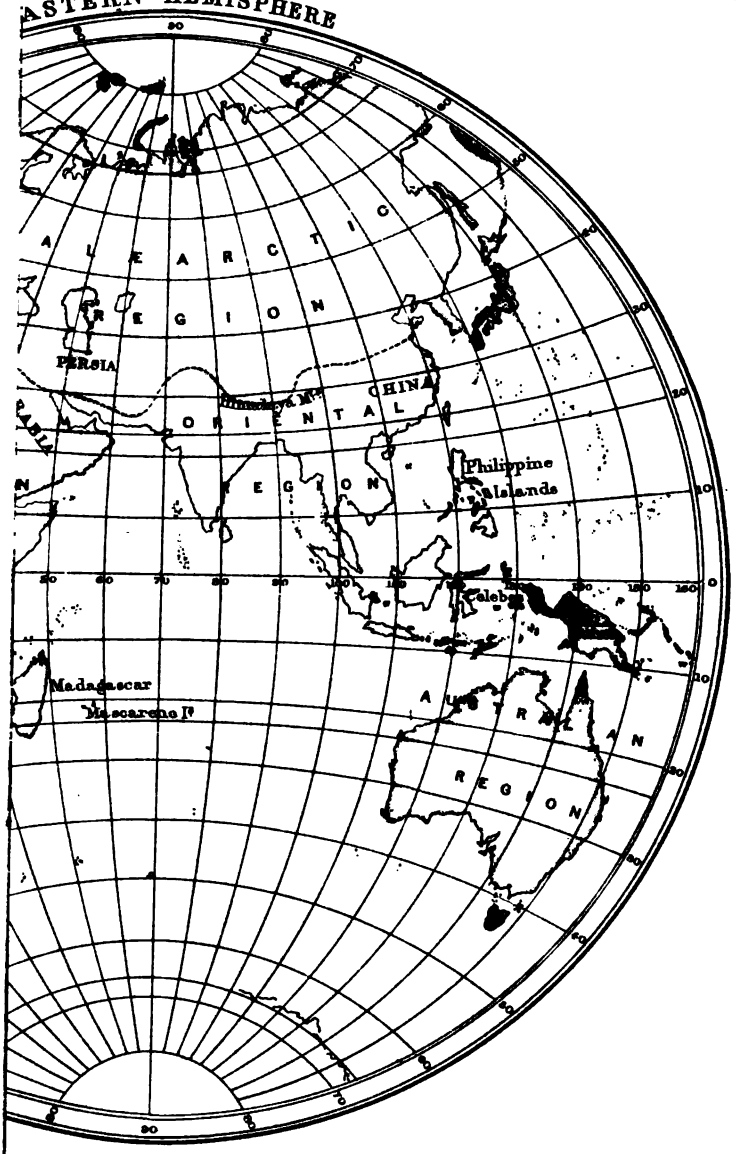
Numbers given in Table I. reduced to Percentages of Total Numbers of Families and Genera.

Regions.	Families.			Genera.		
	Endemic.	Quasi-endemic.	Wide-spread.	Endemic.	Quasi-endemic.	Wide-spread.
1. Australian .	31	18	50	60	7	32
2. Neotropical .	35	17	46	79	11	12
3. Ethiopian . .	23	4	71	66	2	32
4. Oriental . .	5	2	91	34	8	56
5. Nearctic . .	9	0	90	30	3	65
6. Palæarctic . .	0	0	100	24	3	71

The groups entirely confined to each region are classed as "endemic"; those that cross the frontiers slightly as "quasi-endemic"; all others are considered as "wide-spread."

The percentages, it will be observed, on account of the omission of fractions, do not exactly make up one hundred in every case.

ASTERN HEMISPHERE



OF MAMMALS.

W. & A. K. Johnston, Edinburgh & London

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CHAPTER II

THE AUSTRALIAN REGION

(PLATE II., p. 50)

SECTION I.—BOUNDARIES OF THE AUSTRALIAN REGION

THE Australian Region, as will be seen by the map (Plate II.), includes Australia, New Guinea, and the Moluccas, together with all the Pacific Islands and New Zealand. It is divided from the Oriental, the next adjacent region, by a line drawn between the two small islands of Bali and Lombok (called Wallace's Line), and passing thence through the Flores and Molucca Seas, between the islands of Celebes on the one side, and Sumbawa, Flores, Bouru, Sula, and Gilolo on the other. All the islands westwards of this line (*i.e.* Bali, Java, Sumatra, Borneo, Celebes, and the Philippines) are included in the Oriental Region; while all the islands to the eastwards, from Lombok to Timor, the Moluccas, and New Guinea, are referred to the Australian Region. Besides this, the Australian Region includes all the islands of the Pacific, from the Pelews and Ladrones in the north-west, to the Sandwich Islands in the north-east, the Marquesas in the south-east, and New Zealand and its neighbouring islands in the south-west.

The boundaries, as above given, correspond with those laid down by Wallace in his work on Geographical Distribution, with the exception that the island of Celebes has been transferred to the Oriental Region.

Celebes, as Mr. Wallace has fully shown in his "Island Life" (14), is an anomalous island presenting a very difficult problem. It has doubtless relations to both the Oriental and the Australian Regions, but has besides many peculiar forms inhabiting it, which do not seem to connect it with either region. On the whole, however, the evidence of the mammals, at any rate, serves to connect it more closely with the Oriental Region, as will be seen by the discussion of the subject in the chapter dealing with that Region.

Section II.—General View of the Mammal-Fauna of the Australian Region

The peculiarities of the Australian Region are very striking. Within its boundaries are found the only representatives of the lowest and most reptilian of the Orders of Mammals; these are the egg-laying forms, *Ornithorhynchus*, *Echidna*, and *Proechidna*, which constitute the order Monotremata (12).

Of the eight generally recognised families of Marsupials, or "Pouched Animals," no less than six are entirely confined to the Australian Region, with the exception of two species of phalanger (*Phalanger ursinus* and *P. celebensis*), which have crossed the boundary into Celebes. The seventh family, the *Didelphyidæ*, or true Opossums, are found only in the Neotropical Region, whence they have intruded into the southern part of the Nearctic Region.

Of the other mammals, the Rodents and the Bats are the only orders at all adequately represented in the Australian Region. To the former belong six genera of *Muridæ*

(Mice), all of which, except the wide-ranging *Mus*, are confined to this Region; the only other Rodent that occurs in it is the Javan Porcupine, which has just crossed the dividing-line between the Oriental and Australian Regions into the islands of Flores and Sumbawa.

The Bats of the Australian Region (3) are very numerous, more especially in the islands to the north of Australia, where the tropical conditions are specially favourable to the development of this group. No less than twenty-eight genera, containing nearly one hundred species of Bats, are met with within the Region, and of these genera eight are not found elsewhere. This is a high percentage, only excelled in the Neotropical Region, which is extraordinarily rich in Bats, having no less than forty-two out of forty-seven genera confined to it.

The five other Orders of terrestrial mammals—the Ungulata, the Carnivora, the Insectivora, the Edentata, and the Quadrumana—may be considered as practically absent in the Australian Region, though members of several wide-ranging genera have just crossed the line of separation, and are represented in some of the islands on the north of Australia; but, with the exception of the Dingo, none of these reach the actual continent of Australia.

The question of the origin of the Dingo has not yet been settled. Although fossil remains of this animal have been found in the recent Tertiary deposits, it is difficult to say whether the Dingo was introduced into Australia by the aborigines or is indigenous. At the present time it appears to be found both in a wild state and in a semi-domesticated condition among the native Australians.

Section III.—Subdivision of the Australian Region

The Australian Region may be most conveniently divided into five Sub-regions (see Plate II., p. 50); these are—

(1) The *Austral Sub-region*, containing—The island-continent of Australia, with the dependent island Tasmania.

(2) The *Papuan Sub-region*, containing—The islands lying to the north of Australia, including (*a*) the Timor group from Lombok to Timor-Laut; (*b*) the Moluccas, of which the chief islands are Morty, Batchian, Gilolo, Bouru, and Ceram; (*c*) the large island of New Guinea; (*d*) the New Britain group, containing New Britain, New Ireland, the Admiralty Islands, and the Solomon group.

(3) The *Maorian Sub-region*, containing—The two islands of New Zealand, together with their outliers the Norfolk, Kermadec, and Chatham Islands, as also the Auckland, Campbell, and Macquarie Islands.

(4) The *Polynesian Sub-region*, containing—The various islands in the Pacific, from the Ladrones in the north-west to the Society and Marquesas in the south-east, of which the principal are New Caledonia, the New Hebrides, and the Fiji and Samoan groups.

(5) The *Hawaiian Sub-region*, containing—The Sandwich-Island group.

Of these, only the first two, the Austral and Papuan Sub-regions, need be considered in detail, as there are, practically speaking, no mammalian inhabitants, except Bats, in the other three Sub-regions.

Section IV.—The Austral Sub-region

The "island-continent" of Australia, as Mr. Wallace terms it, has, as has now been positively ascertained, a large portion of its interior so parched up and barren as to be almost destitute of animal life. But all along the east and south-east coasts, where there is land of sufficient elevation to condense the vapours from the adjoining ocean, more fertile districts are found. Besides the more widely diffused Australian types, some peculiar forms are met with only on this side of the continent. Tasmania, which is, in fact, but a recently separated piece of this portion of Australia, has also a moister and less extreme climate, and contains representatives of many of the special Australian forms, besides some indications of an autochthonous fauna.

The most peculiar mammals of Australia, and those which first claim our attention, are its representatives of the two forms which together constitute the Sub-class of Monotremes. These are the extraordinary genera *Ornithorhynchus* and *Echidna*, which in their toothless jaws, in the conformation of their sternum and shoulder girdle, and especially in the structure of their reproductive organs, exhibit unmistakable signs of divergence towards the Classes of Reptiles and Amphibians. The first of these, usually known to the colonists as the "Duck-bill" or "Water-mole," (see Fig. 1, p. 23) is entirely aquatic in its habits, and is met with only in the streams and waterholes of New South Wales and Tasmania, where it burrows in the banks, and swims and dives with great facility. The Echidna, or "Spiny Ant-eater," is more widely distributed, and, as we

shall presently see, has also representatives in the Papuan Sub-region. It inhabits the scrubs throughout the eastern districts of Australia, and is likewise occasionally found as far along the southern coast as Western Australia. In Tasmania a slightly different species (*Echidna setosa*) with

FIG. 1.—THE DUCK-BILL.
(*Ornithorhynchus anatinus*).

longer fur, almost concealing the spines (by some authors considered to be only a geographical race or sub-species of the typical form), is met with.

After the Monotremes, the most important group of mammals, and that which constitutes by far the most prevalent feature of Australian mammal-life, is the great

order of Marsupials. Although not absolutely restricted to Australia, since one of its component families is purely American, the Marsupials, from their prevalence, constitute a still more noticeable feature of the Australian fauna than the Monotremes. Of the seven families into which this order is usually divided by naturalists, six are entirely confined to the Australian Region. Moreover, the Marsupials are so abundant in Australia proper, as to quite overshadow the few representatives of the higher orders of mammals found within its limits.

The carnivorous Dasyures (*Dasyuridæ*) forming the first of these families take the place in Australia of the true carnivora of other parts of the world. They are semi-nocturnal in habits, and prowl about at dusk in search of the smaller mammals and birds which constitute their food. In Tasmania two peculiar forms of Dasyures occur, which are not met with in the Australian continent. These are the Thylacine, a dog-like animal with a long tapering tail, noticeable as being the largest of living carnivorous Marsupials (Fig. 2, p. 25), and in general external appearance so much resembling our familiar domestic friend that the uninitiated can hardly be persuaded that its proper place is in a different order of mammals; and the *Sarcophilus ursinus*, or Tasmanian Devil, as it is popularly called—a somewhat aberrant dasyure of a prevailing black colour, about the size and somewhat of the shape of an English badger, and remarkable for its savage and voracious disposition. Both these animals, now confined to the island of Tasmania, must have formerly extended into Australia, as their remains have been found fossil in the caves of the Wellington Valley of New South

Wales. Altogether the Dasyures number some twenty species in Australia and Tasmania.

Besides the Dasyures, a second type of the same family, but in many respects divergent in structure, is found on the mainland of Australia. This is the *Myrmecobius*, or Banded Ant-eater, a little animal of the size and somewhat

FIG. 2.—THE THYLACINE.
(*Thylacinus cynocephalus.*)

of the likeness of the common squirrel, with a long bushy tail and elegant transverse stripes across the back. The *Myrmecobius* is terrestrial in its habits, and feeds principally on ants. It is apparently confined to the western and central parts of the sub-region.

The *Peramelidæ*, or Bandicoots, the second family of

Australian marsupials, have also teeth adapted to an insectivorous diet, although we know, from the records of trustworthy observers, that some of the species feed more or less upon vegetable substances. Such is certainly the case with the Rabbit-eared Bandicoot (*Perogale lagotis*) of Western Australia, which is abundant over the grassy plains of that colony, and, from its burrowing habits and large hare-like ears, is commonly known as the "Native Rabbit." Of the typical bandicoots (*Peromeles*), five or six species are known, distributed over various portions of Australia, each colony having its peculiar forms. They are all purely terrestrial animals, some inhabiting the densest scrubs, and others the hot stony ridges of the upland plains. The only remaining member of the family *Peromelidæ* is the anomalous Pigfoot (*Chœropus castanotis*), a small rat-like animal with slender feet, which is confined to the hard stony grounds of the interior of the southern Australian colonies.

A most interesting discovery has recently been made in the deserts of Central Australia of a new burrowing marsupial, of mole-like habits, for which it is necessary to constitute a new family. This little animal has been described by Dr. E. C. Stirling (9) under the name of *Notoryctes typhlops*, and is apparently very rare (Fig. 3, p. 27). As its name implies, it is quite blind, its eyes being represented merely by pigment spots buried beneath the skin and muscles; furthermore, its whole structure is admirably adapted for its burrowing life. Full descriptions of both its habits and anatomy will be found in the *Transactions* of the Royal Society of South Australia for 1891.

We now come to the herbivorous marsupials (*Diprotodontes*), of which there are three families all confined to the

Australian Region (unless the newly-discovered *Cænolestes* of South America shall be ascertained to belong to the Diprotodonts) namely, the Wombats (*Phascolomyidæ*), the

FIG. 3.—THE NOTORYCT.
(*Notoryctes typhlops.*)

Phalangers (*Phalangeridæ*), and the Kangaroos (*Macropodidæ*).

The Wombats are numerically of the least importance of the three families above mentioned, although the form and general appearance of the animals of the single known genus, *Phascolomys*, are hardly less remarkable than those of the Kangaroos.

There are three species of Wombat (Fig. 4) generally recognised, one of which is confined to Tasmania; they are clumsy-looking animals, resembling in their form and actions small bears. They never climb trees, but live entirely on the ground or in burrows and holes, feeding on grass, roots, and other vegetable substances. In general structure the Wombats are closely allied to the next

FIG. 4.—THE COMMON WOMBAT.
(*Phascolomys mitchelli.*)

family, the Phalangers, although their exclusively terrestrial habits naturally involve minor points of difference, which, added to the characters presented by their dentition, have induced naturalists to recognise them as a separate family.

The Phalangers (*Phalangeridæ*), which next follow, are a much more extensively developed group of animals, presenting us with several well-marked generic forms,

and with about twenty-one readily distinguishable species in the Australian mammal-fauna.

While the Kangaroos are mostly grazing animals, and the Wombats burrowers and grubbers, the Phalangers are essentially arboreal in their habits, and are much more strictly nocturnal than the two former groups. In the daytime the Phalangers lie concealed in the hollows of trees, issuing forth at night to feed amongst the branches upon leaves, buds, and fruits. The Koala, or "native bear" (*Phascolarctos*), of which form a single isolated species only is known, serves to connect the Phalangers with the Wombats, being allied to the latter by many characters, and amongst others by the absence of a tail, which distinguishes it from the rest of its family. In *Pseudochirus*, *Trichosurus*, and *Dromicia*, the more typical forms of the *Phalangeridæ*, which next follow, the tail is not only well developed, but is of vital importance to the animal, being used as a prehensile organ. The flying Phalangers of the genera *Petaurus*, *Gymnobelideus*, and *Acrobates*, do not employ their caudal appendages in the same way. But this organ, which is much elongated in all these groups, and densely clothed with hair, serves, along with the membrane extended between the fore and hind legs, in the manner of the flying squirrels (*Pteromys*), to support the animal in the air when descending from the top of one tree to the base of another.

One more very singular little animal must be enumerated before we leave the Phalanger family—the Tarsipes (*Tarsipes rostratus*), small in size, but great in interest, even among the many abnormal forms of this wonderful land. The Tarsipes is of the size and general form of an ordinary mouse, but with a long slender-pointed muzzle,

and with the nails of the toes for the most part embedded in the upper surface of the expanded fleshy pads, with which they are terminated, thus affording some resemblance to the abnormal lemuroid mammal *Tarsius spectrum* of the Indian Archipelago, whence its name is derived. Another peculiarity of the Tarsipes is that its food appears to be exclusively honey, no other substance having been found in the stomachs of the specimens examined, and its long and slender tongue being obviously adapted, like the bill of the humming-bird and the brush-tongue of the lories, for collecting such food.

The Kangaroos (*Macropodidæ*) must be considered as *par excellence* the most important group of the Australian mammal-fauna. They are at once the most numerous in species, and in the former condition of Australia, before the influx of Europeans took place, were probably likewise the most prevalent form of mammalian life as regards individuals. In his great work on the mammals of Australia, Mr. Gould has devoted the whole of the second volume to the illustration of members of this family, figuring no less than forty-four species. Mr. Thomas, in his catalogue of the Marsupialia (12), has recognised forty-five species.

These are divided into eleven genera, of which the best known and largest are *Macropus*, *Dendrolagus*, and *Bettongia*. The first of these genera contains the larger kangaroos, in which the upper incisors are of equal length, the canine teeth are deciduous when present, and all the toes of the fore feet are of nearly equal length. One of the finest and most brightly coloured of this larger group is the Red Kangaroo (Fig. 5, p. 31), which has been introduced into Europe, and breeds freely in our zoological gardens.

Dendrolagus includes four species of Tree-kangaroos, of which, however, only one is found in Australia, *Dendrolagus lumholtzi* of Northern Queensland, the others being confined to New Guinea. They are remarkable for the fact

FIG. 5.—THE RED KANGAROO.
(*Macropus rufus.*)

that the proportionate lengths of the fore and hind limbs, unlike those of the true kangaroos, resemble those of ordinary mammals; they further differ from all other kangaroos in being arboreal in their habits, climbing trees with great facility, and living on bark, fruits, and leaves.

Bettongia and its allied genus *Potorous* embrace the Kangaroo-rats, as they are often termed. These are all small, never exceeding a rabbit in size; they possess well-developed canine teeth, and have the central toes of the fore feet elongated to accommodate their digging habits.

Having completed our survey of the Monotremes and Marsupials of the Australian Sub-region, we must now consider the Eutherian series, which, as has been already shown, plays a very subordinate part in this extraordinary fauna. Putting aside the marine mammals—the Seals, Cetaceans, and Sirenians—and confining our attention to the terrestrial groups, we find only three of the usually recognised orders, namely, the Rodents, Bats, and Carnivores, with any representatives in this strange country. And the Carnivores would be perhaps better considered as quite external to the fauna of Australia proper, since the solitary member of this group found within its limits is the semi-domesticated Dingo, which, as already suggested, has not improbably been introduced by the primitive native inhabitants.

Monkeys, Insectivores, and the most useful Order of Ungulates, to which its grassy plains would appear to be, and, as we know by actual experience are, excellently adapted, are alike unknown, except as introductions, in Australia, and their functions in a state of nature seem to be performed by the various groups of Marsupials.

Of the other orders, the Rodents are represented by six genera, all belonging to the Mice (*Muridæ*). Of these four are confined to Australia proper, while two others also occur in the Papuan Sub-region; the remaining one, the

cosmopolitian *Mus*, or true Mouse, numbers no less than eighteen species in Australia. The habits of the Water-voles of Europe are assumed by the species of the genus *Hydromys*, which are modified for aquatic life, while the species of *Hapalotis* are found chiefly in the dry sandy scrubs.

The Bats, with one exception, all belong to genera of considerably wide distribution, and the number of species known to inhabit Australia is not very great. Thirty only are described in Dr. Dobson's catalogue of the Bats as Australian. *Pteropus*, the great genus of Fruit-eating Bats, is represented by a few species; so too are the widespread insectivorous genera *Vesperugo* and *Miniopterus*. One species of the former genus, the Southern Pipistrelle (*V. abramus*), is found almost throughout the Old World, from Sweden to North Australia.

Section V.—Analysis of the Austral Mammal-fauna

The full list of the Mammalian Fauna of the Austral Sub-region contains the names of about 169 species, referable to fifty-nine genera. Of these genera twenty-nine, just half, are not found outside the Austral Sub-region, the greater number of them (twenty-five) being Marsupials; they include, however, three genera of Mice (*Xeromys*, *Hapalotis*, and *Mastacomys*) and one peculiar Bat (*Rhinonycteris*). Thirteen genera are confined to the Australian Region, that is, are found in the Papuan Sub-region as well as in the Austral Sub-region; of these, again, the majority are Marsupials, besides which there

are two genera of Rodents (*Hydromys* and *Uromys*), and one Bat (*Nyctophilus*). Seventeen genera which are found in Australia extend beyond the limits of the Region, to the Oriental, and in some cases range even into the Ethiopian and Palæarctic Regions. Of these the greater number (fourteen) are Bats; one is a Marsupial (*Phalanger*), of which two species occur in Celebes; another is the widely spread genus *Mus*, which is found throughout the Old World; and the last is a Carnivore (*Canis*), of which the Australian representative is the Dingo. *Canis* is spread over the whole of the rest of the world, both Old and New.

Turning now to the distribution of the genera within the continent of Australia itself, it will be found that out of forty-three genera (of Monotremes, Marsupials, and Rodents), twenty are fairly represented throughout the whole area, thirteen are confined to the east (several of these ranging north into New Guinea), seven are restricted to the western and central parts of the continent (these latter are chiefly desert forms such as *Perogale*, *Chœropus*, and *Notoryctes*), and the three remaining genera are found only in Tasmania. These are *Thylacinus*, *Dasyurus*, and *Mastacomys*.

If now we reconsider the list, counting only Monotremes, Marsupials, and Rodents, it will be found that out of 130 species, thirty-five range from west to east to greater or less extent; forty-nine are confined to the eastern part of Australia, in many cases extending to Tasmania; and thirty-six are peculiar to Western Australia, while ten species out of the whole Mammal-fauna are peculiar to Tasmania.

Section VI.—Past History of the Mammal-fauna of the Austral Sub-region

The past history of the Australian mammals is still very obscure; the only remains of extinct species yet discovered have been found in certain bone-caves and in surface-deposits generally attributed to the Pleistocene Epoch.

Putting aside the Dingo, all the Pleistocene mammals of Australia belong to the Monotremes or to the Marsupials, and, with two exceptions, can be accommodated in still existing families. These exceptions are *Nototherium* and *Diprotodon*, the latter of which was a very large animal, equalling a Rhinoceros in bulk, but both of them were probably allied to the existing Kangaroos.

Recently a deposit containing bones of these and other large Marsupials has been found in a dry salt lagoon, called Lake Mulligan, in South Australia, and when these remains have been worked out, a great deal more information as regards this pliocene or pleistocene fauna may be expected. As in South America, these extinct animals appear in many cases to have attained a size far surpassing that of their degenerate descendants.

None of the remains hitherto found in Australia throw much light on the origin of its remarkable fauna. But quite recently evidence of an extensive mammalian fauna has been discovered in certain beds, of probably Upper Eocene age, in Santa Cruz, Patagonia. In addition to a number of other forms, this series contains the remains of many Marsupials, and though the most prominent of them belong to the *Didelphyidæ*—the Marsupial

family now confined to America, and apparently distributed over the whole northern hemisphere during Tertiary times, but not found in Australia—a certain number of them show an Australian stamp. Some of them have even been relegated by Ameghino (1), to whose researches our knowledge of the Santa Cruzian fauna is mainly due, to the existing Australian family *Dasyuridæ*.

If, on further investigation, these references shall be found to be correct, the inference would seem to be that in very remote times—probably in the early Tertiary or the late Secondary Period—there has been some sort of land-connection between South America and Australia. In such case there would be no necessity to suppose that Australia was ever directly connected with the rest of the Old World at all, none of the peculiar forms of Australian Marsupials having yet been detected in any other part of the globe.

Besides the common possession of Marsupials, many other resemblances between the faunas of Australia and South America have been pointed out to occur among the Birds and Amphibians, and especially among the Fishes. Two families of freshwater fishes (*Galaxiidæ* and *Haplochitonidæ*) are found exclusively in these two Regions, and are not known to occur elsewhere.

Apart from speculation, however, there is no question that Australia has been isolated from all the other continents since the end of the Secondary, or at least since the beginning of the Tertiary Period of geological time.

Section VII.—The Papuan Sub-region

In contrast to Australia, the great island of New Guinea, or Papua, is traversed throughout by mountains of high altitude. The rivers rising in these ranges, aided by the suns of the tropics, produce a luxuriant vegetation, and such a country as we should suppose would be especially favourable to mammal-life. Yet mammals are by no means abundant in New Guinea and in the adjacent islands which constitute the Papuan Sub-region. As is the case in Australia, the greater number of the indigenous animals of New Guinea and the neighbouring islands consist of Monotremes, Marsupials, and Rodents, together with a certain number of the cosmopolitan order of Bats (8, 10, 11).

Of the Monotremes, two species have been met with in New Guinea, both of them belonging to the family of Echidnas above referred to. Of these one species, only at present known from the south of New Guinea, is but a slightly modified form of the small Australian Echidna. But in the mountains, in various parts of New Guinea, has been lately discovered a larger representative of the same family (*Proechidna*), which, moreover, differs from the typical form in having only three toes on its fore limbs, and in other particulars (Fig. 6, p. 38).

The Papuan Marsupials, as yet discovered, are about thirty-three in number, and embrace representatives of the Dasyures, Bandicoots, Phalangers, and Kangaroos, which are also characteristic families of the Australian mammal-fauna.

There are only two genera of Marsupials peculiar to the

Papuan Sub-region. One of these is *Distœchurus*, a small mouse-like animal belonging to the family of Phalangers, and remarkable for its long tail, which bears at its tip a double row of hairs on either side, and thus resembles a feather. The other genus is *Dorcopsis*, containing three species of animals somewhat nearly allied to the true

FIG. 6.—THE PAPUAN ECHIDNA.
(*Proechidna bruijni.*)

Kangaroos. A third genus (*Dendrolagus*), containing Kangaroos specially modified for arboreal life, was formerly supposed to be peculiar to New Guinea. But a species of the same form, as already mentioned, has been ascertained of late years to exist in Northern Queensland also, thus giving further proof of the close alliance of the Papuan and Austral mammal-faunas.

Nearly all the Marsupials found in the Papuan Sub-region are confined to the island of New Guinea; a few, however—for example, the Phalangers—also inhabit the other islands of this Sub-region. The Grey Cuscus (*Phalanger orientalis*) extends from Amboyna in the Moluccas and from Timor all across New Guinea, and as far east as New Britain and the island of San Christoval in the Solomons. As regards the remaining orders of mammals, a few scattered representatives of the higher forms (Ungulates, Insectivores, and Carnivores) are found in the islands of the Papuan Sub-region. Some of these have, undoubtedly, been introduced by the Malays from the neighbouring islands of the Oriental Region; but others have been described by naturalists as peculiar species. In the latter case, even if we assume that the specific distinctions have been satisfactorily established, it is not probable that such species have been brought into the Papuan Region by the hand of man. It is more likely that they have migrated into it at an earlier period, since a considerable lapse of time is necessary before the effects of isolation can produce new races of sufficient distinctness from the original form to be entitled to specific separation. As regards the Papuan Ungulates, several kinds of Swine (*Sus*) are stated to be met with in the Papuan Region. How far these differ from one another, and whether they are really distinct from the allied wild pigs of the Oriental Region, seems a little uncertain. It is probable, however, that many of these so-called "species" of wild pig may be descendants of the domestic animal, which has run wild, as is well known, in many of the Pacific Islands. The other representatives of the Order Ungulata found in the Papuan Sub-region are three species of Deer belonging to what is

termed the Rusine group of the genus *Cervus*. Two of these deer are confined to Timor and the Moluccan group of islands respectively. All three are closely allied to the Javan Deer (*Cervus hippelaphus*), and it is quite possible that they are merely dwarfed forms of this species.

Passing over, for the present, the Rodents and Bats, the Carnivora are represented in the Papuan Region by three species. These are a Cat (*Felis megalotis*), of which very little is known, but which is stated on competent authority to be quite a distinct species, and to be confined to the islands of Timor and Rotti; a Palm-cat (*Paradoxurus hermaphroditus*), and a Civet (*Viverra tangalunga*). Of these two the Palm-cat is found in both the Moluccas and the Timor group, the Civet only in the Moluccas. These animals have in all probability been introduced by the Malays, since they are both frequently kept by them as pets in captivity.

The Order Insectivora is represented in the Papuan Sub-region by about five species of small Shrews (*Crocidura*), but, so far as is yet known, these occur only in the Moluccas and in Timor, and do not reach further east. Lastly, two species of Monkeys just enter the margin of the Sub-region, namely, the Common Macaque (*Macacus cynomolgus*), very widely distributed throughout the Oriental Region, which has crossed "Wallace's Line" into Flores and Timor; and the Black Ape of Celebes (*Cynopithecus niger*), which has passed the narrow straits between that island and Batchian, one of the Molucca group.

The Rodents are represented in the Papuan Sub-region by a considerable number of rats and mice of the family

Muridæ, all of them restricted to the Sub-region. One of these, remarkable for its peculiar and probably prehensile tail, is found only in the mountains of New Guinea, and has been placed in a new genus (*Chiuromys*). Among the Rodents also there is one very obvious intruder from the west; this is the Javan porcupine (*Hystrix javanica*), which in this Sub-region is found only in Timor, but is very widely distributed throughout the Oriental Malayan Islands.

Finally, the Papuan Sub-region, with its luxuriant vegetation and tropical forests, seems to be extremely favourable to the presence of Bats, of which there are more than sixty species known to occur within its limits. More especially is this the case with the large fruit-eating bats of the genus *Pteropus*, since about twenty out of the forty known species of this genus are found within this Sub-region. This genus (*Pteropus*) has a remarkable area of distribution, which it is difficult to account for satisfactorily. Its range extends from Madagascar and the neighbouring Mascarene Islands through the Seychelles to India, Ceylon, Burma, and the Malayan Archipelago, and includes even Southern Japan; thence it is continued over all the Papuan Sub-region into Australia and most of the Polynesian Islands. This genus, it may be noted, seems to have a special propensity to peculiar development in insular areas. Out of about forty species of *Pteropus* as yet known, only two (*Pteropus medius* from India, and *Pteropus edulis* of the Malay Peninsula) are found on the main continental mass; all the other species are confined to islands, and in many cases to very small limits. For instance, one species (*P. livingstonii*) is restricted to the Comoro Islands in the Indian Ocean, three others to single

islands in the Solomon group, and a fourth is only known from the island of Lombok.[1]

Section VIII.—Analysis of the Papuan Mammal-fauna

The number of genera of mammals represented in the Papuan Sub-region is fifty; of these eight are restricted to the Sub-region (namely, *Proechidna*, *Distæchurus*, *Dorcopsis*, *Chiuromys*, *Pteralopex*, *Nesonycteris*, *Melonycteris*, and *Anthops*). There are also twelve genera, nearly all marsupials, common to the Papuan Sub-region and Australia; and sixteen genera common to the Papuan Sub-region and the Oriental Region. Of these, however, only six (*Sus* and five genera of bats) penetrate so far eastwards as New Guinea; the other ten are stragglers over "Wallace's Line" as far as the Timor group and the Moluccas only. Thirteen genera (*Phalanger*, *Mus*, and eleven genera of Bats) are found in both the Oriental Region and in the Papuan and Austral Sub-regions.

[1] The most recent list of Papuan mammals, published by Dr. K. M. Heller (Abh. Mus. Dresd. vi., No. 8, 1896–97) gives the number of species now known as follows—

	Genera.	Species.
1. Monotremes	2	3
2. Marsupials	14	36
3. Sirenia	1	1
4. Ungulata	1	2
5. Rodentia	5	18
6. Carnivora	2	2
7. Insectivora	1	1
8. Chiroptera	16	39
	42	102

Section IX.—The Maorian Sub-region

The Maorian Sub-region includes, besides New Zealand proper, many smaller groups of islands in the sea around, such as Norfolk Island, the Kermadec group, Chatham Island, Stewart Island, Auckland Island, Campbell Island, and Macquarie Island, and probably Lord Howe's Island, though in some respects this appears to belong rather to the Australian mainland than to New Zealand.

As in the Polynesian Sub-region, there are no indigenous terrestrial mammals found in this Sub-region, the only exception being a species of rat (*Mus maorium*). But it is quite possible, nay, probable, that this Rat, as its name seems to imply, was brought by the invading Maoris into New Zealand from Tonga, or from wherever the Maoris originated; indeed, Mr. Thomas believes it to be identical with a Polynesian species, *Mus exulans* (*cf.* Buller, *Trans. N. Z. Inst.*, xxv. p. 49). The only two bats recorded from New Zealand are *Mystacina tuberculata*, the genus as well as the species being restricted to New Zealand; and *Chalinobus morio*, which is also found in Australia.

The islands of New Zealand are indeed remarkable as being the only insular area on the globe, of any considerable size, which are entirely destitute of mammal-life. All the other large islands of the world possess a Mammal-fauna of greater or less extent related to the continent to which they are nearest, and have consequently been termed by Mr. Wallace "continental islands." All such "continental islands" are separated by narrow seas, of no great depth, from their respective continents. New

Zealand alone, of all the larger islands of the globe, is disconnected by a considerable breadth of ocean (about 1400 miles) and also by a deep sea (more than 2000 fathoms) from the nearest point of mainland.

This fact and the absence of an indigenous Mammal-fauna show that New Zealand has not been joined directly by land with Australia recently, even in a geological sense of that term; possibly it has never been so connected at all.

To determine, therefore, the geographical affinities of this Sub-region, we must turn to the birds and to the other lower groups, and so endeavour to gain an idea of the affinities of these interesting islands. In New Zealand the want of mammals has been apparently supplied in former epochs by the great development of two families of flightless birds. One of these groups, the Kiwis (*Apterygidæ*), is still represented by five or six species, although these birds are being rapidly exterminated by the British colonists. The other group, the Moas (*Dinornithidæ*), is now quite extinct, but as remains of their skin and feathers have been found in some of the caves of the Southern Islands, and as the ancient legends and songs of the Maoris contain unmistakable references to them, it is probable that they have ceased to exist only within the last few hundred years.

In addition to the flightless birds, recent and extinct, New Zealand still possesses two very singular forms of Parrots (*Nestor* and *Stringops*), for the reception of which special families have been formed; and eighteen other peculiar genera of land-birds, most of which are related more or less remotely with Australian forms. Altogether there are in New Zealand fifty-seven land-birds, belonging to thirty-

four genera, of which sixteen, or nearly half, are not known elsewhere. There are also five peculiar genera of waders and aquatic birds in New Zealand, making twenty-one indigenous genera in all. Among its few reptiles, also, New Zealand numbers the very remarkable Tuatera (*Sphenodon punctatus*), which, though externally resembling a lizard, differs from all other lacertians in so many points of its skeleton and internal structure that it is usually considered to belong to a separate and distinct order of reptiles. The nearest allies of this form are found among three extinct families which make up the order *Rhynchocephalia*. Remains of these families occur in beds of Permian age in Germany, in the Keuper of Elgin (Scotland), and in the (probably contemporaneous) Gondwana beds of India, as likewise in the lower Eocenes of North America and Northern Europe.

All these facts indicate a great amount of individualism in the Maorian Sub-region. But on the whole they betray an affinity to the tropical parts of Australia and to the Papuan Sub-region rather than to the temperate portion of Australia, to which New Zealand is now nearest in point of actual distance. This connection is further confirmed by the soundings of the seas round the islands, which show that, although on the west, south, and east deep water extends all round, a long submerged bank, with a depth of less than 1000 fathoms, stretches along to the north-west, and connects the shallow waters round Australia with those round New Zealand.

It is probable that the land connection between the two areas, if it ever actually existed, took place somewhere along this line.

As already mentioned in the first chapter of this volume,

some writers on Geographical Distribution, especially Professor Huxley and Professor Newton, are inclined to give to New Zealand and its islands the rank of an independent Region among the primary divisions of the globe. There is, no doubt, as has just been shown, a good deal to be said for this proposal; but, on the other hand, there are even stronger reasons for retaining New Zealand as a Sub-region of the Australian Region. In the first place, we are here dealing with Mammals alone, and it seems rather absurd to assign the value of a primary Region to a group of small islands characterised by the almost entire absence of that class of animals with which we are most concerned. In the second place, looking at Regions from a more general point of view, there is a great practical convenience (as Mr. Wallace has pointed out) in keeping the more or less equal divisions of the globe as primary divisions. It seems, therefore, to be quite unnecessary to elevate so small a portion of the world into a Primary Region. Other small insular areas might, with some justice, put forward nearly similar claims. In the third place, although New Zealand possesses no indigenous terrestrial Mammals, yet the fauna, such as it is, shows an unmistakable affinity of various degrees to that of Australia, and more especially to the tropical part of that continent. It is, indeed, probable that the whole of the fauna of New Zealand has been originally derived from that source, although in the greater number of cases it has undergone considerable modification.

Dr. H. O. Forbes (4) has lately published a speculative article on the former existence of a (now mostly submerged) southern continent, the remains of which are represented by the land round the South Pole, while

former arms stretched upwards and embraced New Zealand, Eastern Australia, Tasmania, Madagascar, the Mascarene Islands, and part of South America. The grounds for this bold assumption, which, although by no means new, has not been previously developed to so great an extent, rest chiefly on the finding of the remains of a large ocydromine rail in the Chatham Islands, allied to the now extinct *Aphanapteryx* of Mauritius, and the fossil bones of a large coot (*Fulica*) allied to *F. newtoni* of the same island. Other evidence adduced is that of the occurrence of the *Ratitæ*, or Struthious birds, in New Zealand, Australia, Madagascar, and Patagonia. But the distribution of Struthious birds is probably to be explained much in the same way as the distribution of other archaic forms, such as the lemurs and tapirs. They are remnants of what were formerly widely spread groups. That this is likely to be the case is shown by the recent discovery, in other parts of the world (such as the Sewaliks of India, and the Eocenes of England and France) of the remains of other extinct Ratite birds.

Another piece of evidence brought forward by Dr. Forbes is the occurrence of *Didunculus* in the Samoan group, and of the Dodo (*Didus*), to which *Didunculus* was once supposed to be nearly related, in Mauritius. But it is now allowed that *Didunculus* has little near affinity to the Dodo, and that it is in fact a mere strongly modified member of the family Columbidæ.

Mauritius, as a matter of fact, is in every way a typical oceanic island, and there seems to be little evidence, either physical or zoological, of its having been ever connected with any other land.

Section X.—The Polynesian Sub-region

The Polynesian Sub-region includes all the numerous and scattered island groups of the Pacific, from the Ladrones and Carolines in the west to the Marquesas in the east, with the exception of the Sandwich Islands, which, owing to their many peculiarities, must be kept apart as a separate Sub-region.

There is very little to be said concerning the Polynesian Sub-region so far as mammals are concerned. As is always the case with oceanic islands—that is, islands that do not seem to have ever been directly connected with any of the great land-masses of the globe—the Mammal-fauna of Polynesia is practically non-existent, the only exception being a certain number of Bats, which are creatures able to traverse the intermediate sea-areas, and so more resembling birds than ordinary mammals in their distribution.

There are, however, besides the Bats, three or four species of the cosmopolitan genus *Mus* (Mice and Rats), recorded to occur in Polynesia, whether truly indigenous or the modified descendants of introduced species it is impossible to say.

Of the eleven species of Bats which have been registered as Polynesian, eight are peculiar to the Sub-region, two extend into Papua, and one ranges even as far as the Oriental Region.

But, looking to the extreme poverty of the Mammal-fauna, it is evident that, to ascertain the general character of the Sub-region, we must turn to the Birds. These, as shown by the excellent summary of Polynesian Ornithology

recently compiled by Mr. Wiglesworth (15), are, considering the number of islands, not numerous, but on the whole show distinctly Australian affinities.

Section XI.—The Hawaiian Sub-region

The Hawaiian Sub-region includes only the Sandwich Islands. This group of islands is situated in the northern part of the Pacific Ocean, and is very isolated, not only from the great land-masses of Asia and America, from which it is separated by a very deep ocean more than 2000 miles across, but also from the other larger groups of the Polynesian islands such as Samoa and the Marquesas, from which it is parted by nearly the same distance.

The larger islands composing the group are seven in number, all of purely volcanic origin.

As would be naturally expected, there are no indigenous land-mammals in the Hawaiian Sub-region, but a single species of bat (*Atalapha semota*) occurs there. This bat belongs to a genus found in America, and has, no doubt, reached the Sandwich Islands from that continent. The birds, however, to which we must turn for a moment in order to gain some idea as to the composition of the Hawaiian fauna, show extreme specialisation. The greater number, not only of the species but even of the genera of this Sub-region, are peculiar and wholly restricted to these islands. It is, of course, among the smaller land-birds (*Passeres*) that this individuality is most marked; but even in the other groups, where the distribution is generally wider, the Hawaiian birds are, in many cases, local. We shall, however, be able to form a better general

idea upon this subject when Mr. Scott Wilson's new work on the Hawaiian Avifauna (16), now in process of issue, has been brought to a conclusion.

As is the case with the Birds, so with the Land-shells, which have been carefully studied by the Rev. J. T. Gulick, a wonderful specialisation is found in the Hawaiian fauna.

There are, therefore, ample grounds for making a separate Sub-region for this remote island group, notwithstanding its small size and the complete absence of mammalian life.

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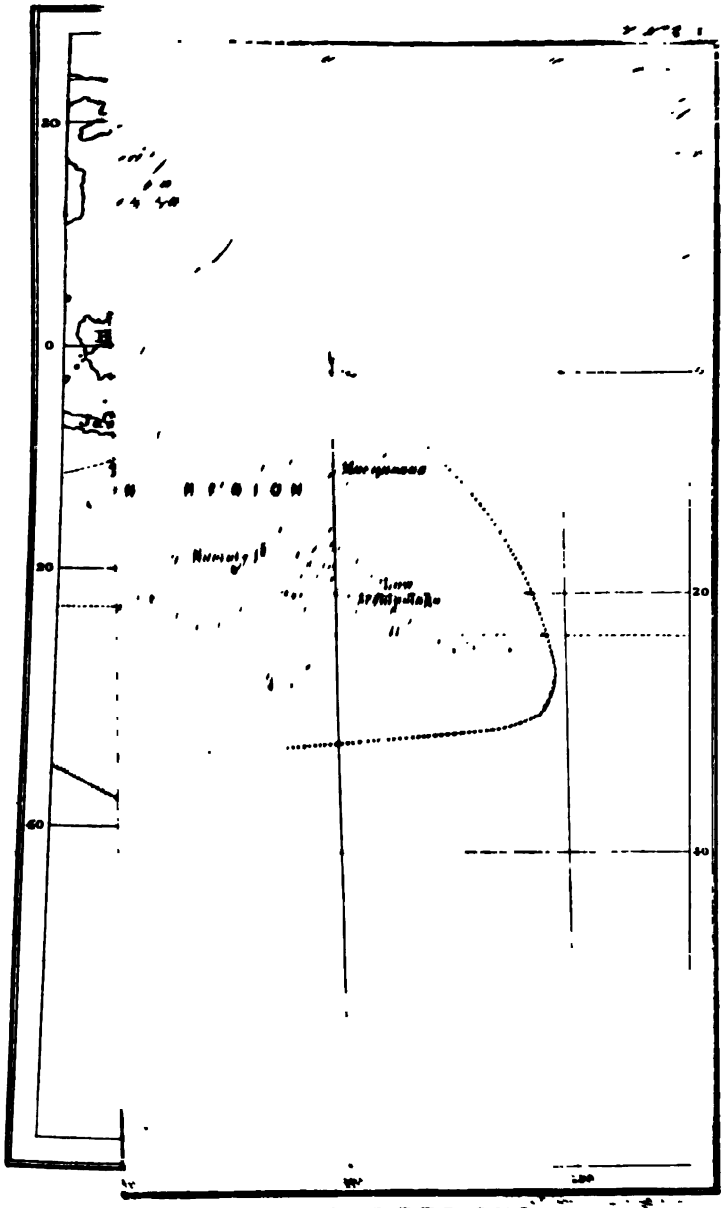

ION INTO 8 SUB REGIONS

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CHAPTER III

THE NEOTROPICAL REGION

(PLATE III., p. 82)

SECTION I.—BOUNDARIES OF THE NEOTROPICAL REGION

THE Neotropical Region is, no doubt, after the Australian, the most distinct of all the regions. It includes not only the continent of South America, but the West Indies, Central America, and a considerable portion of Southern Mexico. As regards its northern termination, on account of the great admixture of Nearctic and Neotropical forms which takes place where the two Regions join, it is impossible to lay down anything but an approximate boundary. Mr. Wallace (11) draws the line from the mouth of the Rio Grande on the Atlantic side to the neighbourhood of Mazatlan, in about the same latitude, on the Pacific side, but bends it down between these two points so as to include in the Nearctic Region the whole of the high tableland down to the city of Mexico.

Some American naturalists, among others Merriam and Allen (1), include in the Neotropical Region the southern extremities of the peninsulas of Lower California and of Florida. This, however, appears to be unnecessary, at least so far as the mammals are concerned, though there are certainly a considerable number of Neotropical birds and insects found in both these districts.

Besides the mainland of Central and South America

and the West Indies, the Falkland Islands and the Galapagos must likewise be included in the Neotropical Region.

The West Indies form an important sub-region, containing some forms of great interest, and will be treated of in detail below.

The Falkland Islands are situated in the south Atlantic, about 250 miles east of the nearest point of Patagonia. They are, however, known to be connected with the mainland by a shallow sea of less than 100 feet in depth, and therefore present all the characteristic features of a "continental" group of islands. The only indigenous mammals are a Wild Dog (*Canis antarcticus*) and a Vesper-mouse (*Hesperomys*), which seem to be distinct, though closely allied to the mainland forms. The birds also are mostly identical with those of the mainland, though there are some just recognisable representative forms.

The Galapagos, a group of five larger and ten smaller islands, are situated in the Pacific, exactly under the Equator, at a distance of from 500 to 600 miles west of Ecuador. They rise up from very deep water, and are entirely of volcanic origin. They are therefore typical "Oceanic" islands. With the exception of two Vesper-mice, slightly differing from those of the mainland, and a peculiar Bat (*Atalapha brachyotis*), there are no indigenous mammals (2) in the Galapagos. There are, however, a considerable number of birds in these islands, most of them not found elsewhere, and many of them restricted to individual islands in which they represent each other (7).

There can be no doubt that the Galapagos have never,

at any period of their history, been joined to the mainland, and that, owing to the fact that they are situated in the region of equatorial calms, immigration from the mainland is very occasional. In this way has been gradually evolved the peculiar fauna, which, although highly specialised, shows abundant evidence of its having been derived from the nearest mainland.

Section II.—General View of the Mammal-fauna of the Neotropical Region

The Neotropical Region is essentially one of luxuriant tropical vegetation, the great mass of the land from Central America to Uruguay being occupied by vast forests. South of the tropic of Capricorn the woods soon disappear, and the country, over a large part of its surface, becomes a flat treeless expanse covered with more or less abundant pasture known as the Pampas, while all along the western coast extends the giant range of the Andes, the eastern flanks of which are, as a rule, well watered and wooded, while the western slopes from the Gulf of Guyaquil to the island of Chiloe facing the Pacific are utterly dry and arid. There are, however, also in the higher parts of Venezuela, the Guianas, and Brazil, open grassy plains called "campos," which rise as islands from a surrounding sea of evergreen tropical forest.

The mammalian fauna of the Neotropical Region is naturally a rich one, but in the number of genera and species falls considerably short of that of the Ethiopian Region. This may perhaps be accounted for by the physical features of the country, which are certainly not

so favourable for mammalian development as the more open and varied country of Africa.

This deficiency in mammalian life is, however, more than counterbalanced by the abundance of other groups of animals, more especially of birds and insects, to the development of which the luxuriant tropical vegetation seems to be especially conducive.

Again, the mammalian fauna of the Neotropical Region is quite as remarkable for what it does not possess (lipotypes) as for what it has. Everything points to the conclusion that during a long geological age, probably throughout the greater part of the Tertiary epoch, South America was entirely isolated from the rest of the world. Thus the present fauna has arisen from two quite different sources —first, from the original fauna of early Tertiary times; and, secondly, from immigrants from the north, some of these being of rather long standing, and others of later arrival.

Of the nine Orders of Terrestrial Mammals, representatives of eight occur in the Neotropical Region, the only Order entirely absent being the Monotremes, which are absolutely confined to Australia.

The Marsupials are represented in the Neotropical Region by a single family only,[1] out of seven into which this order is usually divided. This is the *Didelphyidæ*, or Opossums, of the twenty-four generally recognised species of which one (*Didelphys marsupialis*) ranges north with some modification into the Nearctic Region. The Quica Opossum (*D. opossum*) (Fig. 7, p. 56) is another well-known

[1] Since this was written Mr. Thomas has described his wonderful new South-American genus *Cænolestes*, which seems to belong to the Australian Diprotodonts. See *P. Z. S.*, 1895, p. 870.

species of the group, which is found all through the Region, from Southern Mexico to La Plata.

The third Order of mammals—the Edentata—is highly characteristic of the Neotropical Region. Of the five

FIG. 7.—THE QUICA OPOSSUM.
(*Didelphys opossum.*)

generally recognised families two belong entirely to the Old World; the other three—the Sloths, the Ant-eaters, and the Armadilloes (which are more nearly allied to one another than to the two Old World families)—are, with the exception of one species of Armadillo (*Tatusia*

novemcincta), which extends into Texas, absolutely confined to the Neotropical Region, and are eminently characteristic of its mammal-fauna. The Sloths (*Bradypodidæ*) of the present epoch at least, are entirely arboreal

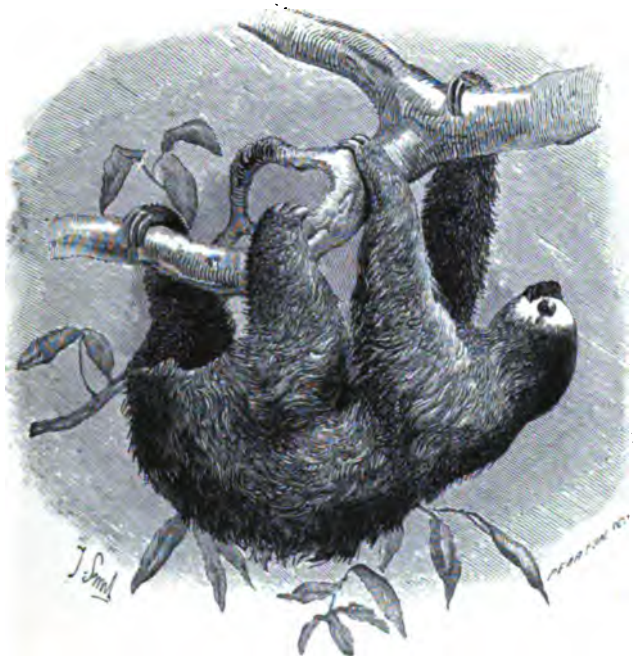

FIG. 8.—HOFFMANN'S SLOTH.
(*Cholopus hoffmanni.*)

in their habits, and pass their lives suspended by their limbs on the underside of the branches of trees (Fig. 8). The Ant-eaters (*Myrmecophagidæ*) are also mainly inhabitants of forests, and one of the three existing forms (*Cyclothurus*) is exclusively arboreal. A second (*Tamandua*) may be said to be semi-arboreal, but the largest—the

Great Ant-eater as it is usually called (Fig. 9)—does not climb trees, though mostly found in forest-districts. These three animals are all widely distributed in the woodlands of tropical America, but never met with elsewhere. The Armadilloes (*Dasypodidæ*) are mostly inhabitants of more open districts (see Fig. 10, p. 59). Besides the three living

FIG. 9.—THE GREAT ANT-EATER.

(*Myrmecophaga jubata.*)

[List of Vertebrates, 1896, p. 197.]

families of Edentates, there are two (the *Megatheriidæ* and *Glyptodontidæ*) now extinct, which are chiefly characteristic of the Neotropical Region, though remains of them have also been found in certain formations in North America (6).

The fourth order of mammals, the Ungulates, is very poorly represented in the Neotropical Region, four only out of the fourteen usually recognised families being found within its limits. The Peccaries (*Dicotylidæ*) consist of only two species, of which one (*D. tajacu*) ranges as far

FIG. 10.—THE THREE-BANDED ARMADILLO.
(*Tolypeutes tricinctus.*)

north as the Southern United States, and the other is confined to the Neotropical Region. A second family, the *Camelidæ*, is shared by the Neotropical Region with the Old World. The representatives of this family in the New World are the Lamas, belonging to the genus *Lama* (see

Fig. 11). They are entirely confined to the higher ranges of the Andes and to the desolate plains of Patagonia.

The Deer (*Cervidæ*) of the Neotropical Region all belong to two peculiar genera (*Cariacus* and *Pudua*), of which the former extends northwards throughout the United States

FIG. 11.—THE LAMA.
(*Lama peruana.*)

to British Columbia, while the latter is found only in Western South America.

Finally, the Tapirs (*Tapiridæ*) are represented by four species, all of which are peculiar to this region, the only other existing Tapir known being the Indian Tapir of the

Malay Peninsula. The explanation of this curious case of discontinuous distribution is afforded by the past history of the group. During Miocene and Pliocene times, members of this genus and its allied forms were found both in North America and also throughout the Old World from France to China. This gives us direct evidence of the former much wider extension of the family of Tapirs, and bridges over the present great gap in its distribution.

As already stated, the fauna of the Neotropical Region is almost as remarkable for the absence of certain families as it is for the presence of peculiar forms. This is specially noticeable in the Ungulates. There is no existing representative of the four great families of the Oxen, Rhinoceroses, Horses, and Elephants in this region, though remains of the latter two groups have been found in most recent deposits of Argentina. Here they were probably immigrants from the north, which survived but a short time in this locality.

Turning now to the Rodents, we find that out of the four chief divisions into which this order is separated—the Squirrels (*Sciuromorpha*), the Mice (*Myomorpha*), the Porcupines (*Hystricomorpha*), and the Hares (*Duplicidentata*)—the first two and the last contain very few peculiar genera and no peculiar families in this Region. But, on the other hand, out of the six families of *Hystricomorpha* four are restricted to this region, while of the remaining two, one (the *Octodontidæ*) is found elsewhere only in Africa, and the other, the Porcupines (*Hystricidæ*) is of wide distribution. Moreover, all the Neotropical genera of the Hystricomorphine division are, without exception, confined to this region.

The Carnivores, which follow next, are well represented in the Neotropical Region, but belong generally to families of wide distribution. But one family, the Raccoons (*Procyonidæ*), with the exception of a single genus (*Ælurus*), which is perhaps doubtfully referred to it, is entirely confined to the New World. On the other hand, the *Viverridæ*, so widely spread in the Old World, are entirely absent in America.

With the exception of some four or five species of Shrews, which have obviously spread southwards from the Nearctic Region, wherein they are found in considerable numbers, the Insectivores are represented in the Neotropical Region only by a single remarkable family. This is the Solenodont—a characteristic form of the Greater Antilles —absolutely unknown elsewhere. The Insectivores are usually considered to be the most generalised of all the mammalian orders, and to be the least changed descendants of the ancestral group from which most of the other orders of mammals have originated. If this be the case, it seems strange that we should find no traces of them on the continent of South America, which was, doubtless, long isolated from the rest of the world, and which still contains many representatives of primitive and declining types. The palæontological history of the Insectivores is, however, as yet very incomplete, as very few fossil forms of this order have been described. It is, therefore, possible that when future discoveries have increased our knowledge on this subject, this seeming anomaly may be explained.

The Neotropical Bats (*Chiroptera*) are of much interest; they are included in three families, of which two (*Vespertilionidæ* and *Emballonuridæ*), although containing several peculiar genera, are found in other parts of the

world, but the third (*Phyllostomatidæ*) is entirely confined to this region.[1]

This family, which numbers among its members the true Vampires or blood-sucking bats (*Desmodus* and *Diphylla*), is a very considerable one, numbering at least sixty species, distributed among thirty-three genera, which are doubtless still to be supplemented by future discoveries.

Finally, the Neotropical Region possesses two families of Monkeys, the Marmosets (*Hapalidæ*) and the Capuchins (*Cebidæ*), neither of which is found elsewhere. Moreover, both these groups are distinguished from their Old World allies by very important anatomical characters, which render them absolutely distinct from the Old World monkeys and apes.

As a representative of this latter family we give a figure of the Barrigudo Monkey (*Lagothrix humboldti*) of Upper Amazonia (Fig. 12, p. 64) of which Mr. Bates has written us an excellent account in his well-known "Naturalist on the Amazons."

Summarising these statements, we find that the Neotropical Region is characterised by the exclusive possession of no less than ten families of mammals, namely:—

Bradypodidæ (Sloths);	Caviidæ (Guinea-pigs);
Myrmecophagidæ (Ant-eaters);	Solenodontidæ (Solenodonts);
Chinchillidæ (Chinchillas);	Phyllostomatidæ (Vampire bats);
Dasyproctidæ (Agoutis);	Hapalidæ (Marmosets);
Dinomyidæ (Dinomys);	Cebidæ (Capuchin monkeys);

and by the presence of about 130 genera, of which about 103 are restricted to its boundaries.

On the other hand, when we compare the fauna of the

[1] One species, *Macrotus californicus*, has wandered as far north as California.

Neotropical with that of other regions, the deficiencies or "lipotypes" are manifestly considerable. For example, the following ten families of mammals, all fairly well

FIG. 12.—THE BARRIGUDO.

(*Lagothrix humboldti.*)

spread over the rest of the world except Australia, are entirely absent from this region:—

Bovidæ (Oxen).
Equidæ (Horses).
Elephantidæ (Elephants).
Lagomyidæ (Pikas).
Viverridæ (Civets).
Talpidæ (Moles).
Pteropidæ (Fruit-bats).
Lemuridæ (Lemurs).
Cercopithecidæ (Old World monkeys).
Simiidæ (Anthropoid apes).

Section III.—Subdivision of the Neotropical Region

The divisions of the Neotropical Region, as based on a consideration of the class of birds (8), are six in number, namely:—

1. The *Antillean Sub-region*, containing the Greater and Lesser Antilles, exclusive of Tobago and Trinidad.

2. The *Central-American Sub-region*, containing all that part of the whole region that is north of Panama.

3. The *Colombian Sub-region*, containing Trinidad and the slopes of the Andes, through Venezuela, Colombia, Ecuador, and Peru, into Bolivia.

4. The *Amazonian Sub-region*, embracing the whole watershed of the Orinoco and Amazons up to the hills, and including the highlands of Guiana.

5. The *South Brazilian Sub-region*, containing the wood region of South-East Brazil, Paraguay, and the adjoining districts.

6. The *Patagonian Sub-region*, containing Patagonia, Southern Argentina, and Chili, and running up the west coast of the continent to Guyaquil.

This division, although perfectly good when the distribution of Birds is mainly relied upon, presents considerable difficulties in the case of Mammals, owing chiefly to our ignorance of the limits of the distribution of the greater number of the South American mammals, especially of the smaller forms. There is, however, no doubt that the Antilles or West Indies (excluding Trinidad and the other islands off the coast of Venezuela, which are connected with the mainland by quite shallow water) form

a very well-marked Sub-region, in which the terrestrial mammals, though not very numerous, nearly all belong to peculiar genera.

The higher ranges of the Andes from Ecuador southwards, together with the pampas of Southern Argentina and Patagonia, form another well-marked Sub-region characterised by a number of peculiar genera and species. But the whole remainder of the Neotropical Region from Mexico to Southern Brazil contains, so far as we understand it at present, a more or less homogeneous mammal-fauna, of which, however, the northern half possesses a considerable admixture of Nearctic forms, while the southern preserves a more purely indigenous facies. It will, therefore, be quite in accordance with the facts of nature, as well as convenient, to separate the northern portion of this extensive area as the Central American (or Transpanamanic) Sub-region. But as regards the southern portion, until our knowledge of the distribution of South American mammals has made greater progress, it seems best to unite the Colombian, Amazonian, and Brazilian Sub-regions of the Ornithologists into one combined Sub-region, which may be called the Guiano-Brazilian Sub-region.

We shall thus have, as regards Mammals, four Sub-regions of the Neotropical Region, as follows (see Map, Plate III., p. 82):—

1. The *Antillean Sub-region*, comprising the whole of the West India Islands except Curaçao, Trinidad, and Tobago.

2. The *Central-American Sub-region*, comprising the low-lying and southern parts of Mexico and Central America as far as the Isthmus of Panama.

3. The *Guiano-Brazilian Sub-region*, comprising the

greater part of South America from the Isthmus of Panama to the southern limits of the great forest in about lat. 30° S., and from the forest of the eastern slopes of the Andes to the Atlantic, including Trinidad and the other islands off the coast of Venezuela.

4. The *Patagonian Sub-region*, comprising the higher ranges and western slopes of the Andes from Guyaquil to Tierra del Fuego and the pampas of Argentina and Patagonia.

Section IV.—The Antillean Sub-region

The Mammal-fauna of the Antillean Sub-region is exceedingly poor, so poor, indeed, that it seems almost doubtful whether the islands of which it is composed have ever been directly connected with the mainland of America as at present constituted. To begin with the Rodents, four genera of this order are represented within its limits, and three of these are restricted to the Sub-region. *Megalomys* (a large rat, over twelve inches in length without the tail) is allied to the Vesper-mice of the American continent, and has been obtained only in the islands of Martinique and St. Lucia, where it is now becoming very rare (10). A more important factor in the Antillean mammal-fauna is *Capromys*, a genus allied, according to Flower and Lydekker, to the Coypu rat of South America, but also showing some affinities to the Porcupines. There are five or six species of this genus usually recognised, of which two or three are restricted to Cuba, one is peculiar to Jamaica, and one to the Bahamas, while another species has been recently discovered in Swan Island, situated

in the middle of the Gulf of Mexico. An allied genus (*Plagiodon*) with one species, differing from *Capromys* only in a slight modification of the teeth, is found in Hayti. It is obviously derived from the same stock. A peculiar species of agouti (*Dasyprocta cristata*) is found in two of the Lesser Antilles—St. Vincent and St. Thomas; the other members of this genus belong to the mainland of Central and South America. The only other Order of terrestrial Mammals represented in this Sub-region is the Insectivora, and this is the more remarkable because, as already shown, one of the special characters of the Neotropical Region is the almost complete absence of this group within its limits. The West Indian representatives of this group are two in number, and belong to a peculiar genus (*Solenodon*), which is of rather doubtful affinities but of family rank. It is allied in some respects to the moles (*Talpidæ*), and in others to a peculiar Malagasian family, the Tenrecs (*Centetidæ*). The Solenodonts are small creatures with a somewhat shrew-like aspect, a long snout, and a long naked tail. There are two representative species of this genus confined to the islands of Hayti and Cuba respectively.

The Bats of the Antillean islands, as would naturally be expected, are somewhat more abundant than the terrestrial mammals. There have been recorded by naturalists about thirty species belonging to some twenty genera as found in the different islands, the greater number being from Cuba and Jamaica. On examining the list, it will be found that of these twenty genera three only seem to be confined to the West Indian Region, while thirteen are spread over the greater part of the Neotropical Region, one belongs to the Nearctic Region, and the others are of wider distribution.

The evidence of the Bats, therefore, points unmistakably to the inference that the West India Islands have been peopled with Mammalian life from South and not from North America. In this connection it may be noted that Mr. Frank Chapman in an instructive article (4) on the origin of the West Indian fauna, recently published, has stated, as regards the birds, that the total number as yet recorded as met with within the limits of this Sub-region amounts to 550. Of these 303 are endemic, while the remaining 247 may be allotted to the countries from which they have been apparently derived as follows:—

Common to North and South America	16
Of general distribution in the tropics	56
South American (ten in the Windward Islands, three only in the Greater Antilles)	13
Central American	3
North American (all annual migrants from the north, through Florida, and the larger proportion found in Cuba)	160

This summary gives us a clue to the origin of the more recent additions to the West Indies fauna, which is obviously by migration from the north. If, however, the relationships of the 303 endemic species of Birds are examined, it will be at once evident that they are all more closely allied to South American than to North American forms, and, like the Bats, show that the islands have been stocked with life from the south. Moreover, Mr. Chapman, as well as Mr. Wallace, has pointed out that nearly all the more distinct and most characteristic West Indian Birds are found in the Greater Antilles (*i.e.* Cuba, Hayti, Porto Rico, and Jamaica), and that the Lesser Antilles form a distinct group, the line of separation between the two provinces coinciding nearly with the deep channel between

the Virgin Islands on the west, and the Anguilla group on the east.

On the whole the Lesser Antilles appear to have derived their fauna direct from South America, but probably in times considerably remote, and without the assistance of a land-connection. The almost complete absence of terrestrial mammals and of representatives of sedentary and non-migratory birds in the Lesser Antilles seems to show this. For instance, Grenada possesses only fifteen land-birds also found in Trinidad, and of these none belong to the sedentary families, although the two islands are only separated by an interval of seventy-five miles of sea. On the whole, therefore, it seems probable that, although the Lesser Antilles have derived the bulk of their fauna from South America, they have never been directly connected with that continent.

Of the Greater Antilles, Jamaica and Cuba have by far the richest endemic faunas, whereas in Hayti and Porto Rico the total number, as well as the number of endemic species, is considerably smaller. Jamaica, therefore, with its small area (one-tenth of that of Cuba, one-eighth of that of Hayti, and a little more than that of Porto Rico), and in spite of its more isolated position, contains on the whole, so far as our present knowledge goes, the richest fauna.

This may, perhaps, be explained by the fact that between the north-east corner of Honduras and Jamaica there stretches a series of more or less shallow banks, so that a comparatively slight elevation of the intervening sea-bottom would very nearly connect Jamaica with the mainland.

Whether such a complete land-connection (or only an

approximation of land areas) by this route ever existed, cannot at present be definitely settled. On the one hand, as pointed out by Mr. Chapman, the disproportionately rich fauna of Jamaica, the shallow sea, and the West Indian affinities of Swan Island (as shown by the presence of a species of *Capromys*) lead to such a direct connection. On the other hand, the scarcity of land-mammals in Jamaica and Cuba, and the absence of many families of Birds found on the mainland, rather point the other way. The help in these questions to be derived from palæontology is up to this time very scanty. Almost the only remains of fossil mammals that have been yet obtained from the West Indies are certain detached teeth and some fragmentary bones, found in some caves in the island of Anguilla, which is situated just to the east of the deep channel separating the Greater from the Lesser Antilles, and must, therefore, be included in the latter province. These remains have been described by Professor Cope (5), who considers them to be related to the Chinchillas, a family of rodents confined to South America.

The nature of the Mammalian genera of the Antillean Region is summarised in the subjoined table :—

	Rodents.	Insectivores.	Bats.	Total.
Endemic	3	1	4	8
Nearctic	0	0	1	1
Neotropical	1	0	12	13
American	0	0	1	1
Cosmopolitan	0	0	2	2
Total . . .	4	1	20	25

Section V.—The Central American Sub-region

This Sub-region, as has been already shown, contains the coast-lands of Mexico lying along the Pacific and Atlantic shores from Mazatlan on the north on one side, and from the Rio Grande on the other, together with the whole of Central America from the Isthmus of Tehuantepec to that of Panama.

As regards the fauna of this part of America, we are fortunate in being able to refer to the excellent account of it contained in the "Biologia Centrali-Americana" of Messrs. Salvin and Godman. The volume relating to the mammals in this work was undertaken by Mr. Alston, and finally completed after his death by one of the authors of this work in 1882 (3). Out of a total of sixty-nine genera of mammals represented in this Sub-region, only two seem to be absolutely restricted to it, and these, moreover, are genera of bats, which may possibly be found at some future time to extend into the main South American continent.

Of the sixty-seven non-peculiar Central-American genera of mammals, forty-one are Neotropical types—that is, found also in one or more of the other Sub-regions of this Region—five are Nearctic, nine are found both in the Nearctic and in other Sub-regions of the Neotropical Region, and twelve are cosmopolitan, or, at any rate, found in some part of the Old World as well as in the New.

These facts show conclusively the thoroughly Neotropical character of the Central-American Sub-region, which, although the admixture of northern forms has really made very little progress, may be defined as that part of the Neotropical Region which has been subjected to an incursion of Nearctic types.

The Marsupials in the Central American Sub-region are represented by two genera containing about seven species, most of which are also found further south. One of these —the common opossum (*Didelphys marsupialis*)—extends northwards into the Nearctic Region as well as far southwards into Brazil, where, however, it has a slightly modified form.

The Edentates are well represented in the Central-American Sub-region by two Sloths, three Ant-eaters, and an Armadillo, although the greater number of these are met with only in the most southern portion of the Sub-region. The Armadillo (*Tatusia novemcincta*) is a widely spread species, ranging from Texas throughout the Sub-region, and extending southwards to Paraguay.

Central America is also remarkable for possessing two out of the four American species of Tapir exclusively confined to it; these are Baird's Tapir (*Tapirus bairdi*), extending from Mexico to Panama, and Dow's Tapir (*T. dowi*), found only in Guatemala and Costa Rica.

Very few of the typical South American Hystricomorphine Rodents extend as far north as Central America. The greater number of the animals of this order found within Central American limits belong to the Sciurine and Murine groups, which have spread southwards from their homes in the Nearctic Region.

Passing on to the Carnivora, we find nearly all the genera of this order met with in the South American continent (amongst which are the Cats, Dogs, Racoons, and Weasels) also represented in this Sub-region. The only exceptions are *Icticyon*, a peculiar form of Wild Dog restricted to South-East Brazil, and the Bear (*Ursus*), a species of which is found in the Andes of Peru.

The Bats of Central America are fairly numerous, and nearly all belong to South American genera. A large proportion of them are referable to the *Phyllostomatidæ*, one of the characteristic Mammal-families of the Neotropical Region.

Finally, as regards the Monkeys, the Marmosets (*Hapalidæ*) appear to be represented only by a single species, which is an intruder into the extreme southern end of the Sub-region. Of the other family of American Monkeys (*Cebidæ*), about eight species, against a total of at least sixty found in the Guiano-Brazilian Sub-region, occur in the Central-American Sub-region. Of these five are peculiar, or not yet ascertained to occur elsewhere.

The following table gives the statistics of the origin and distribution of the Central-American genera of Mammals. The "Endemic" genera are those confined to this Sub-region; the "Nearctic" genera are those common to this Sub-region and the Nearctic Region; the "Neotropical" genera are those common to this Sub-region and one or more of the other Sub-regions of the Neotropical Region; "American" designates those found in both the Neotropical and Nearctic Regions, and "Cosmopolitan" those met with also in the Old World.

	Marsupialia.	Edentates.	Ungulates.	Rodents.	Carnivores.	Insectivores.	Bats.	Monkeys.	Total.
Endemic	0	0	0	0	0	0	2	0	2
Nearctic	0	0	0	2	2	1	0	0	5
Neotropical . . .	1	4	1	6	2	0	22	5	41
American	1	2	0	0	4	1	1	0	9
Cosmopolitan . . .	0	0	1	4	4	0	3	0	12
Total . .	2	6	2	12	12	2	28	5	69

The inspection of this table will show at a glance that the Central-American Sub-region is predominantly "Neotropical" as regards its mammals, but has received a small immigration of Nearctic forms, and possesses only few endemic types.

Section VI.—The Guiano-Brazilian Sub-region

This extensive area, in which is combined three of the Sub-regions usually allotted to Birds, is the largest and by far the richest of the four divisions of the Neotropical Region adopted in the present article. It extends from the Isthmus of Panama in the north to about 30° south latitude. But the southern frontier between this and the Patagonian Sub-region is very undecided, the Fauna of Uruguay and the northern part of the Argentine Republic containing forms characteristic of both Sub-regions. The western boundary is formed by the well-watered and forest-clad western slopes of the Andes, the waterless eastern slopes, together with the western slopes of Peru and Bolivia from the neighbourhood of the Equator downwards, being referable to the fourth or Patagonian Sub-region.

The greater part of the Guiano-Brazilian Sub-region consists of forest, and the Mammalian fauna, though tolerably abundant, is not nearly so profuse as that of the Birds and Insects, which are here both developed in far greater luxuriance than in any other part of the world.

This Sub-region is more especially the home of the peculiar Platyrrhine monkeys, the arboreal Sloths, and other tree-loving Mammals.

Beginning at the bottom of the list, we find that nearly

all the twenty-four species of Opossums known from the New World are found within its limits. The peculiarly modified Water-opossum (*Chironectes*) occurs all over its area, but also extends into the Central-American Sub-region.

Among the Edentates the Sloths are the most characteristic inhabitants of its forests. But two peculiar genera of Armadilloes (*Xenurus* and *Priodon*) are confined to this Sub-region, and several other species of this group occur there. All three genera of Ant-eaters are also here met with.

Rodents are very abundant in this Sub-region, but, with the exception of Squirrels (*Sciurus*), Vesper-mice (*Hesperomys*), Pouched mice (*Heteromys*), and a single Hare (*Lepus*), they all belong to the Hystricomorphine group, which is so highly developed in the Neotropical Region.

The Guiano-Brazilian Sub-region is also the special home of the Phyllostomine bats. Out of a total of about sixty-five species of this family forty-four are found in this Sub-region, and the greater number of them are confined to it. Such, too, is the case with the Platyrrhine monkeys. The Marmosets (*Hapalidæ*) would be also unknown outside the limits of the Sub-region had not a single species, as already mentioned, overstepped the northern boundary at Panama. The Capuchins (*Cebidæ*), numbering more than sixty species and belonging to ten genera, are likewise abundant, and are found elsewhere only in the Central-American Sub-region.

The following table shows at a glance the numbers of (1) the "Endemic" genera of this Sub-region, *i.e.* those not found beyond its limits; (2) the "Neotropical" genera, *i.e.*

those confined within the limits of the whole Region; (3) the "American" genera, *i.e.* those occurring in other parts of the New World, but not beyond; and (4) the "Cosmopolitan," *i.e.* those of general distribution :—

	Marsupials.	Edentates.	Ungulates.	Rodents.	Carnivores.	Insectivores.	Bats.	Monkeys.	Total.
Endemic	0	2	0	9	1	0	11	7	30
Neotropical . . .	1	6	0	8	1	0	23	5	44
American	1	1	2	0	4	1	1	0	10
Cosmopolitan . . .	0	0	1	3	4	0	3	0	11
Total . .	2	9	3	20	10	1	38	12	95

Section VII.—The Patagonian Sub-region

The Patagonian Sub-region may be most conveniently taken to begin on the south side of the bay of Guyaquil, and to extend thence southwards, embracing the whole western slope of the Andes of Ecuador and Peru. In Bolivia it widens out and includes the high plateau of Titicaca, extending thence over the whole of the Argentine Republic, Chili, and Patagonia.

The most characteristic form of the mammals of this Sub-region is the Lama, which, with its allies, constitutes the genus *Lama*. Four forms, usually regarded as distinct species, are recognised by naturalists. Of these two, the Lama (*L. peruana*) and the Alpaca (*L. pacos*) are only met with in a domestic state, and are very variable in size and colour. Of the other two, which are met with wild, the Guanaco (*L. huanacos*) has the most

extensive distribution, ranging from the highlands of Ecuador and Peru, along the Andes, to the open plains of Patagonia; while the Vicugna (*L. vicugna*), which is a somewhat smaller animal, is found only in Ecuador, Peru, and Bolivia.

In addition to the Lamas, this Sub-region possesses a species of thickly haired mountain Tapir, differing from the lowland forms, and two or three peculiar Deer, of the sub-genus *Furcifer*, which are likewise densely furred. A third diminutive deer found in Chili is distinguished from *Cariacus*, the ordinary American form of deer, by anatomical characters, and belongs to a special genus, *Pudua*. A second species of this form (*P. mephistopheles*) from the highlands of Ecuador has lately been described by Mr. De Winton.

The Rodents of the Patagonian Sub-region almost all belong to the Hystricomorphine section of the Order. Amongst them are the Chinchillas (*Chinchilla* and *Lagidium*), noted for their delicate fur, the Viscacha (*Lagostomus*), and the Patagonian Cavy (*Dolichotis*). Out of the eighteen genera of this division known to occur in the Patagonian Sub-region, ten are restricted to it.

Of the carnivorous Mammals of this Sub-region, one of the most interesting is the Spectacled Bear of the Andes (*Ursus oratus*), which affords an instance of that rare phenomenon in nature "discontinuous distribution," the nearest allied species of bear (the black bear of North America) only coming as far south as Mexico. The presence of a bear in the Andes can only be explained by the supposition that the ancestral form migrated southwards along the line of the Cordilleras, but has died out in the intermediate district. The Bats of the Patagonian

Sub-region present but few features of interest; they are, with one exception, all of genera found also in the Guiano-Brazilian Sub-region.

As might have been expected from the dearth of forests and the generally severe climate, the American monkeys and marmosets are entirely unrepresented in the Patagonian Sub-region. On the other hand, at least two small species of Opossum (*Didelphys* and *Dromiciops*) occur in Chili, and a very remarkable form of Armadillo (*Chlamydophorus*) is peculiar to Argentina and the high plateau of Bolivia.

The following list of the mammal genera of the Patagonian Sub-region is constructed on the same plan as that of the preceding tables:—

	Marsupials.	Edentates.	Ungulates.	Rodents.	Carnivores.	Bats.	Total.
Endemic	1	2	2	10	1	1	17
Neotropical	0	2	0	7	2	5	16
American	1	1	1	0	1	2	6
Cosmopolitan . . .	0	0	1	1	4	2	8
Total . .	2	5	4	18	8	10	47

Section VIII.—The Past History of the Neotropical Mammal-fauna

During the last few years our knowledge of the extinct mammals of the Neotropical Region has been enormously increased by the discoveries of the palæontologists of the Argentine Republic, more particularly by the labours of

Burmeister, Moreno, and Ameghino. A few words about this branch of the subject may be added.

The oldest formation containing well-preserved remains of mammals yet investigated is in the neighbourhood of Santa Cruz, in Southern Patagonia, where the deposits are about 200 feet in thickness. The exact age of the Santa Cruz beds it is very difficult to determine, but the best authorities consider that they cannot be of earlier date than the Upper Eocene or Oligocene of Europe. Following these in point of time, are the so-called "Patagonian" beds of Patagonia and Uruguay, which are probably of Miocene age. The "Araucanian" formation of Ameghino, which is well developed at Monte Hermoso, near Bahia Blanca, in Southern Argentina, seems to correspond approximately with the older European Pliocene. Finally, the later Pliocene is apparently represented by the "Pampas" formation of Argentina and Uruguay. Our knowledge of the extinct mammal-faunas of these beds is mainly due to the efforts of the Argentine palæontologists just mentioned, but a clear *résumé* of the work done will be found in a recent number of the *Geological Magazine* (12).

In the "Santa Cruz" beds have been found remains of about 120 genera of mammals referable to the following groups:—

Marsupials.	Perissodactyles.	Rodents.
Edentates.	Toxodonts.	Monkeys.

Among the Marsupials the most prominent forms in this formation are the Opossums (*Didelphyidæ*), which are still found all over America, and in Tertiary times appear to have been distributed nearly all over the northern hemisphere. But accompanying these are other forms of the

same Order, which seem to be more nearly related to the Australian marsupials of other families; in fact, Ameghino has placed some of them in the (hitherto supposed to be) exclusively Australian family *Dasyuridæ*.

The fossil Edentates of this formation are all of the American section of the group. The Perissodactyle Ungulates are represented by two families (*Proterotheriidæ* and *Macraucheniidæ*) not very definitely connected with other Perissodactyles, and unknown elsewhere; and the Toxodonts (another group forming a distinct sub-order of the Ungulata) are also quite unrecognised outside South America, where, indeed, they appear to have existed for a short period only.

The Rodents of this formation all belong to the Hystricomorphine section of the order, and the Monkeys are all Platyrrhine, so that, except in the case of the Marsupials where the results are to a certain extent doubtful, no clue to the origin of the Neotropical fauna is shown by this extinct fauna. When these results are compared with the Eocene Mammal-fauna of the northern hemisphere, the absence of Artiodactyles, Insectivores, Bats, Carnivores, and Lemurs, is very striking.

The "Patagonian" beds contain a Mammal-fauna only to be distinguished from the previous "Santa Cruz" series by a further differentiation of genera belonging to the same orders without any traces of foreign admixture. When, however, we reach the more recent Araucanian formation, we find, in addition to the Edentates, Toxodonts, and other typical South American forms, a number of foreign intruders, such as Tapirs, Lamas, Elephants (*Mastodon*), and Wild Dogs (*Canis*), of an entirely different aspect. There can be little doubt that these animals had migrated

here southwards from North America, where their remains (or those of closely allied species) have been likewise found in the nearly contemporaneous formations of the United States.

Moreover, it would seem that in these bygone days, not only did the northern forms move southwards, but that also some of the southern forms emigrated northwards. This is evidenced by the fauna of the so-called "*Equus*-beds" and "*Megalonyx*-beds" of a slightly later date in the United States, which contain a composite Mammal-fauna of northern forms mixed with forms usually considered to be exclusively South American—such as the gigantic armadillo-like *Glyptodon*, the Capybara (*Hydrochœrus*), *Toxodon*, and others.

Finally, in the age of the "Pampas" beds, the peculiar South American Mammal-fauna seems to have reached its culminating-point, and to have far exceeded that of the present day both in number of species and in the size of the individuals. This great increase in size, which is, as a rule, accompanied by an extreme specialisation of individual organs, seems to have had a fatal effect on its possessors, as none of the larger Edentates or Toxodonts appear to have outlived the end of the pampas formation. Along with most of the larger arrivals from the north, such as *Mastodon* and *Equus*, they became extinct. All the conclusions to be derived from this much-abbreviated account of the extinct Mammals of South America, confirm in a remarkable way the evidence of the present fauna as to this history of the Neotropical Region. Up to the last period of the Tertiary epoch, South America was certainly isolated from the rest of the world, and the connections with Australia and with Africa, if they ever did exist, must have been previous to this

period. At the beginning of Pliocene time, during the deposition of the Araucanian formation in Argentina and the "*Equus*-beds" in the United States, a wide bridge between North and South America, affording an easy road to migrating animals, must have existed, and this again seems to have become considerably narrowed to form the present Isthmus of Panama.

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CHAPTER IV

THE ETHIOPIAN REGION

(PLATE IV., p. 122)

SECTION I.—BOUNDARIES OF THE ETHIOPIAN REGION

THE Ethiopian Region (see Map, Plate IV.) contains the whole of Africa south of the Sahara, together with Southern Arabia and the island of Madagascar. As in all other cases where there is a long land-frontier between two neighbouring Regions, so here it is impossible to lay down anything but an approximate line of demarcation between the Ethiopian and Palæarctic Regions.

The boundary usually adopted is the line of the Tropic of Cancer, which strikes Africa between Morocco and Senegambia, runs through the middle of the Sahara, crosses the Nile between the first and second cataracts, and passes through Arabia to the neighbourhood of Oman, on the Persian Gulf. Most of the country through which this line passes is desert, and its mammalian fauna is consequently meagre. Mr. O. Thomas (6) has recently published an account of a collection of mammals received at the British Museum from Oman, which shows, as would naturally be expected, that "the geographical relationships of this district are about equal with Africa and India; three of the species being distinctly African in affinities, three Indian, and the remainder either peculiar or widely spread and of no special significance." On the whole,

therefore, the line of the tropic of Cancer, adopted by Wallace, seems to be a fairly suitable boundary.

Besides the island of Madagascar and its appendages, which contain one of the richest and most interesting of all known Insular Faunas, and form a very important Sub-region, which will be considered in greater detail below, the Ethiopian Region possesses other islands. These, however, are mostly Oceanic, and not of any great importance.

The Azores, Madeira, Canaries, and Cape Verde groups, although geographically African, seem to have derived their animals chiefly from Europe. They therefore belong to the Palæarctic Region, and will be dealt with under that head.

The islands of St. Helena and Ascension, situated in the South Atlantic, are both of them of volcanic origin, and separated from the mainland of Africa by more than 800 miles of deep water. Neither of these islands possesses any Vertebrates. The only land-groups well represented in them are the Beetles and the Land-shells—a study of which shows that the affinities of these islands are to Southern Europe and Southern Africa, but that the Fauna is in all probability an exceedingly ancient one; since its peculiarities are very great, and opportunities of migration of new forms to these islands have been few and far between.

The other islands in the Atlantic connected with Africa are Fernando Po, Prince's Island, St. Thomas, and Anno Bon, all situated in the Gulf of Guinea at various distances from its head. Fernando Po, an island of some 40 miles in length, but separated from the mainland by a somewhat shallow sea about 20 miles across is said to be

inhabited by a considerable number of Mammals which, however, in all probability, also occur on the adjacent mainland.

The other islands above mentioned, Prince's Island, St. Thomas, and Anno Bon, are all considerably more distant from the coast of Africa, and, so far as we know, do not possess any native Mammals. A certain number of Land-birds have been obtained from these islands, and a few of these are peculiar, but they are all closely allied to forms that occur in the neighbouring West African mainland.

The most important islands in the Indian Ocean are, apart from Madagascar, Socotra, the Seychelles, the Amirante Islands, the Comoros, and finally Réunion, Mauritius, and Rodriguez.

Socotra is situated about 150 miles due east of Cape Guardafui, the extreme eastern point of Africa. Its fauna and flora were carefully investigated some years ago by Professor Bayley Balfour (1). He found that the only Mammals inhabiting the island are a Bat, which he was unable to obtain, and a Civet (*Viverricula*), met with also in South Asia, and probably introduced by human agency.

The Seychelles are distant about 700 miles from the northern point of Madagascar in a north-easterly direction, a more or less continuous chain of islands (Amirante, Providence, and Farquhar) forming a series of stepping-stones between them. But two narrow deep channels of over 1000 fathoms run between the Seychelles and Amirante on the one hand, and between Amirante and Providence on the other, thus cutting the Seychelles off from Madagascar by their deep water.

There do not appear to be any indigenous terrestrial Mammals in the Seychelles, except two Bats, which have been recorded as occurring there. The Land-birds are most of them peculiar, though belonging to genera found in Madagascar or Africa; the reptiles and amphibians are fairly numerous for islands such as these, and several of the species are not found elsewhere. It is difficult to say whether these islands have ever had a land-connection with Madagascar, but probably, if such were ever the case, it was at a remote time, geologically speaking.

The Comoros are a group of several islands lying about midway between the most northerly point of Madagascar and the mainland of Africa. They are separated from Africa by the Mozambique channel, more than 1000 fathoms in depth, while the depression between them and Madagascar is considerably less. Inhabiting these islands there are three Bats. Two of these are of the genus *Pteropus*, which is entirely absent from the mainland of Africa, but is found in Madagascar and many islands of the Indian Ocean. There is also a peculiar species of Lemur (*Lemur mayottensis*) and the Indian Civet (*Viverricula*), which last is also found in Madagascar and Socotra, and has in all probability been introduced by human agency. A fair proportion of the Land-birds of the Comoros, though in some instances peculiar, belong to Madagascar forms, and everything goes to show that the relation of this group of islands is with Madagascar rather than with the mainland.

The islands of Réunion, Mauritius, and Rodriguez are distant from Madagascar in an easterly direction 450, 550, and 800 miles respectively. They are all of volcanic origin, and separated from Madagascar by water of more

than 2000 fathoms in depth. As would be expected, these islands are thoroughly Oceanic, and possess no indigenous Mammals or Amphibians; while the Land-birds are few in number, and belong mostly to genera found in Madagascar. The most remarkable feature, however, of the Fauna of these islands is the former existence of a group of flightless Ground-birds now quite extinct, but some of which were found in great numbers when the islands were first discovered. These are the Dodos of Mauritius and Réunion respectively, and the Solitaire of Rodriguez. These birds form a distinct family—the *Dididæ*, probably allied to the Pigeons, but of somewhat obscure affinities. It seems that the ancestors of these birds must have reached the islands in very early times, and that most of the striking peculiarities exhibited by them were gradually acquired after their arrival in the group.

We may, at any rate, conclude that these three islands are truly Oceanic, and that they have never had a land-connection with Madagascar or elsewhere.

Section II.—General View of the Mammal-fauna of the Ethiopian Region

The Ethiopian Region, as will be seen by looking at the Tables of the numbers of families, genera, and species given at the end of Chapter I. (p. 16), is the richest of the six Regions as regards the total numbers of its families, genera, and species of mammals, although the percentage of peculiar forms not found in other Regions is hardly so high as in the Neotropical and Australian Regions. This may, however, be accounted for by the consideration that there is a long

land-frontier between the Ethiopian and the Palæarctic Regions, though this is chiefly occupied by desert.

Out of the nine orders of Terrestrial Mammals the Ethiopian Region contains representatives of seven, the

FIG. 13.—THE CAPE AARD-VARK.

(*Orycteropus capensis.*)

Marsupials and Monotremes being alone absent. The Edentates of this Region are represented by two families. One of these, of which the sole genus is the Aard-vark (*Orycteropus*), is quite restricted to the Region (see Fig. 13).

The other, containing the scaly ant-eaters (*Manidæ*) is found also in the Oriental Region (see Fig. 14). These two forms are in most respects more closely allied to one another than to any of the Edentates of the New World.

It is, however, the animals belonging to the Order

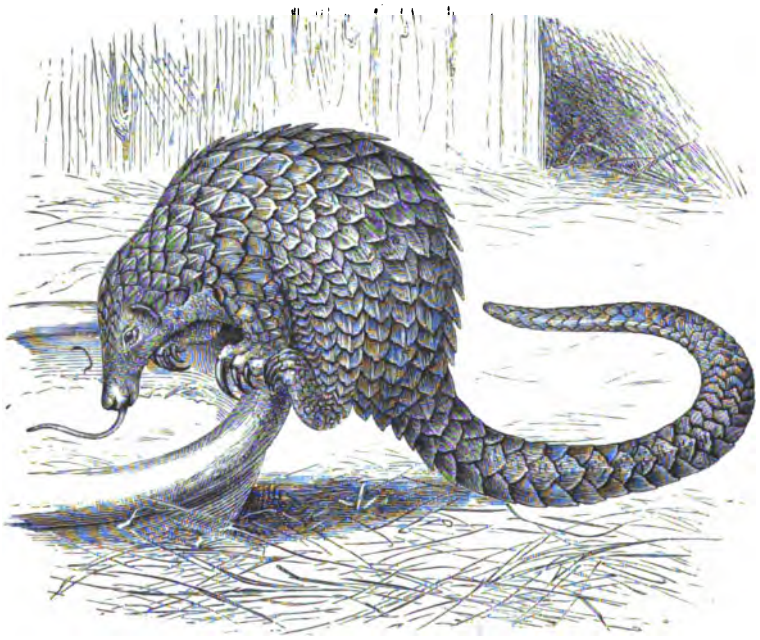

FIG. 14.—THE WHITE-BELLIED PANGOLIN.

(*Manis tricuspis.*)

Ungulata which form so conspicuous a factor in the Ethiopian fauna. These are distributed among thirty-nine genera, of which no less than twenty-four are not found anywhere outside this Region.

The antelopes, of the family *Bovidæ*, which are most

of them large animals living in vast herds in the more open country of eastern and southern Africa, take up the greater number of these genera. These are perhaps, at the present epoch, the most notable feature of the African Fauna, but will doubtless, owing to the unceasing persecution of hunters and sportsmen, become rapidly less so. Already the larger Antelopes are nearly extinct in the Cape

FIG. 15.—THE HIPPOPOTAMUS.
(*Hippopotamus amphibius.*)

Colony south of the Orange River, and there can be little doubt that, unless special precautions are taken, the large Mammals of Africa will very soon disappear, like those of the United States, before the express and repeater.

Beside the numerous genera of Antelopes, the Ethiopian Region has exclusive possession of two other conspicuous forms of the Ungulates—the Hippopotamus (Fig. 15) and

the Giraffe (Fig. 16), each of which forms a special family

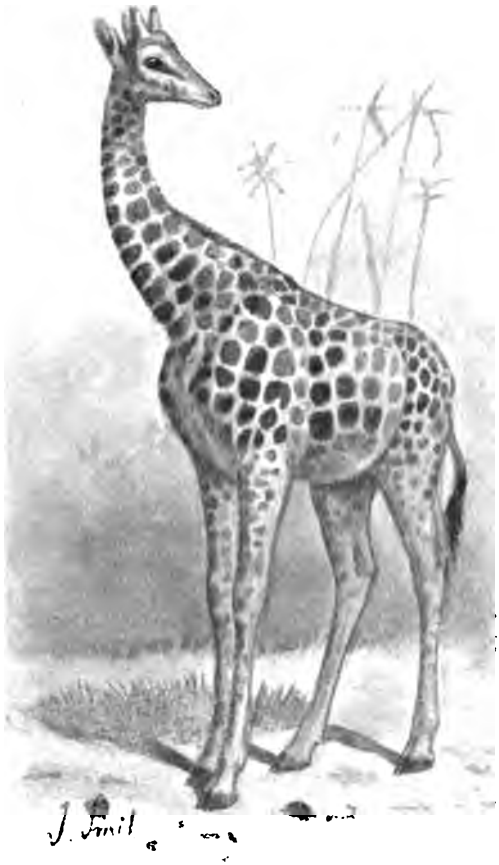

FIG. 16.—THE GIRAFFE.
(*Giraffa camelopardalis.*)

while it shares the Rhinoceroses and the Chevrotains with the Oriental, and the Horses (*Equidæ*) with the Palæarctic

Region. The only important family of Ungulates not found in the Ethiopian Region is the Deer-family (*Cervidæ*). The total absence of this otherwise widespread family it is difficult to explain. Palæontology does not help us much, since the members of the Deer-tribe appear to have been already well established and abundant in Europe during early Pliocene times, and were contemporaneous with Antelopes and other Ungulates, which have availed themselves of the opportunity of spreading southwards to Africa, while the *Cervidæ* have apparently remained obstinately attached to the Palæarctic Region.

The Sub-order Proboscidea containing the Elephants is in these days represented only in the Ethiopian and Oriental Regions. The Hyraxes (*Hyracidæ*) are absolutely confined to the Ethiopian Region, and constitute one of its most significant forms of mammal life, as not being elsewhere met with.

Turning now to the Rodents, we find that the Ethiopian Region possesses representatives of a considerable number of genera, twenty-seven of which, out of a total of thirty-nine, are confined to the Region. Two of these genera are sufficiently distinct to be entitled to family rank. These are, first, *Anomalurus*, a form resembling the flying squirrels in having a flap of skin available for imperfect flight extended between the fore and hind limbs. But the Anomalures differ from the true Flying Squirrels (*Pteromys*) in having a long cartilaginous process extending from the elbow-joint to support the parachute, and also in being provided with strong imbricated scales attached to the lower surface of the tail, which are probably of assistance in climbing.[1]

[1] A new genus of Anomaluridæ (*Zenkerella*), lately described by Herr Matschie, has the imbricated scales on the tail, but no parachute. See *P. Z. S.* 1898, p. 450.

The second peculiar Rodent of family rank is *Lophiomys*, a curious arboreal animal allied to the rats, but differing from them in several anatomical features, and in having a long crest of hair upon the back. Only one species is known, which is restricted to North-East Africa.

The distribution of a third Ethiopian family of Rodents (*Octodontidæ*) is particularly interesting, as it is represented in South America by a considerable number of genera, and is not found elsewhere except in the Ethiopian and on the borders between the Ethiopian and Palæarctic Regions. There are four African genera of this family, each with a single species, so that in the Old World the group appears to be in a state of decay. The only light thrown on this curious case of discontinuous distribution is the occurrence of a fossil genus (*Pellegrinia*) allied to the African forms in the Pleistocene beds of Sicily. This indicates that members of this family once had a wider distribution northwards than what they now retain.

The Carnivora are well represented in the Ethiopian Region. This is especially the case with the family of Civets (*Viverridæ*), only found elsewhere in the Palæarctic and Oriental Regions. Out of a total number of seventeen genera, three only are found outside this region, and out of the remaining fourteen, six are confined to the island of Madagascar.

The Aard-wolf (*Proteles*), which is so distinct from its fellow Carnivores as to be allowed to constitute a family of itself (Fig. 17, p. 95), is restricted to the Ethiopian Region, and of the Hyenas (*Hyænidæ*), only one of the three species strays outside its limits, into the western borders of the Oriental Region.

Another remarkable fact about the Ethiopian Carni-

vora is the entire absence of the otherwise widespread family of Bears (*Ursidæ*). This group has existed in Europe since the time when the Upper Pliocene beds were laid down, and remains of Bears have been also found in the Siwalik deposits of India, which are possibly

FIG. 17.—THE AARD-WOLF.
(*Proteles cristatus.*)

of even greater age. It seems, therefore, very strange that the Bears should never have reached Africa, when so many of the other genera found in the same deposits have managed to do so.

The Insectivora of the Ethiopian Region are fairly numerous, and show considerable specialisation. Out of

the six Ethiopian families three are not found elsewhere, and one of the others only extends into the Palæarctic Region as far as Northern Africa. This is the family of elephant-shrews (*Macroscelidæ*).

The Bats of this Region present few particular features of interest, belonging nearly all to widely spread genera of widely spread families. Among those that are peculiar the most important is *Epomophorus*, containing eight or ten species of large fruit-eating bats, with long rather horse-like heads, and expansible and peculiarly folded lips. The *Epomophori* seem to take the place, in Africa, of the genus *Pteropus*, which, although represented by several species in Madagascar, and even in the Comoros (which are separated from the mainland by only a comparatively narrow strait), is entirely absent from the African mainland itself.

Among the Lemurs we have two families, one containing only a single species (*Chiromyidæ*) confined to Madagascar, the other (*Lemuridæ*) containing a large number of genera, of which ten are confined to Madagascar, two are found on the mainland of Africa, and the other two in the Oriental Region.

The Quadrumana of the Ethiopian Region, which are entirely absent from Madagascar, belong to two families, both of them shared with the Oriental. The genera, however, six in number, are all without exception confined to this Region. In the first place this Region is the only home of the Gorilla and Chimpanzee (Fig. 18, p. 97), two of the Apes most nearly allied to Man in structure, and usually placed at the apex of the mammalian series. The Colobs, or Thumbless Monkeys (*Colobus*), represent the Langurs (*Semnopithecus*) of the Oriental Region in

Africa, and number some ten or twelve species. The long-

FIG 18.—THE CHIMPANZEE.
(*Anthropopithecus troglodytes.*)

tailed *Cercopitheci*, or Guenons, are essentially arboreal, and are spread all over tropical Africa where trees are

found. They are very numerous, and from thirty to forty species have been described, some of them, such as the Diana Monkey (*Cercopithecus diana*) and Brazza's Monkey (*C. brazzæ*) remarkable for their beautifully coloured fur. Intermediate between the Guenons and the Macaques of the Oriental Region are the Mangabeys (*Cercocebus*), of which some six species are recognized. Finally, the terrestrial Baboons (*Theropithecus* and *Cynocephalus*) close the Ethiopian series with some eight or ten species.

Summarizing these results, therefore, we find that the Ethiopian Region is characterized by the exclusive possession of eleven families of mammals, namely—

Orycteropodidæ (Aardvark),
Hippopotamidæ (Hippopotamus),
Giraffidæ (Giraffe),
Hyracidæ (Rock-coney),
Anomaluridæ (Anomalure),
Lophiomyidæ (Crested Tree-rat),
Protelidæ (Aard-wolf),
Potamogalidæ (River-shrew),
Centetidæ (Tenrec),
Chrysochloridæ (Golden-mole),
Chiromyidæ (Aye-aye),

and by the presence of about ninety-nine endemic genera.

On the other hand, among a considerable number of families not represented in this Region, the following five are all widely spread elsewhere, and may therefore be considered as typical "lipotypes" of the Ethiopian Region :—

Cervidæ (Deer).
Tapiridæ (Tapirs).
Castoridæ (Beavers).
Ursidæ (Bears).
Talpidæ (Moles).

Section III.—Subdivision of the Ethiopian Region

In dividing the Ethiopian Region into Sub-regions, it must be always remembered that one of the Sub-regions far predominates over the others in speciality and distinct-

ness, and that the remaining Sub-regions all resemble one another more or less closely, and are difficult of separation.

This Sub-region, which is so distinct from the others, consists of the large island of Madagascar, together with the island-groups in its immediate vicinity, viz., the Comoros, the Seychelles, and Amirantes to the north, and the Mascarene islands (Réunion, Mauritius, and Rodriguez) to the east. Whatever other conclusions may be arrived at regarding the best mode of dividing the Ethiopian Region, every authority is, we believe, agreed on this matter, the only doubtful point being whether the Malagasy Sub-region is not well entitled to the full rank of a Region.

On the African continent itself a fairly distinct Sub-region can be recognized, extending all over the forest country of Western Africa from the Senegal River over the whole Congo basin, or perhaps rather further south. The best inland boundary of this Sub-region would probably be the water-parting between the West African rivers on the one side, and the Nile on the other. There can, at any rate, be now little doubt that the West African fauna extends nearly as far eastwards as the western bank of Lake Tanganyika. Even on the shores of Victoria Nyanza, according to Herr Neumann's (5) recent researches, some typical West African forms are met with; but for the present it will be safer to restrict the West African Sub-region to the western watershed. The Southern or Cape Sub-region, as defined by Wallace, includes only the country south of a line drawn from Walfisch Bay, just to the north of the tropic of Capricorn, to Mozambique. Since the publication of Mr. Wallace's book, however, much additional information has been obtained regarding the distri-

bution of the mammals of Eastern Africa. Many of the animals formerly supposed to be confined to the southern end of the continent, have been shown to extend all through Nyasaland, at least as far north as British East Africa. It will, therefore, be advisable to extend the boundaries of this Sub-region further north. The boundary adopted in this paper, as will be seen by consulting the map (Plate IV., p. 122), runs from Angola in the west, along the southern water-parting of the Congo as far as Lake Tanganyika, passing thence to Kilimanjaro, and so on to the Indian Ocean along the Tana River.

The rest of Africa, including the Sahara, the southern portion of Arabia, and North-East Africa, will form a fourth Sub-region, which, however, does not contain nearly so high a percentage of endemic genera as the other three.

The Ethiopian Region may therefore be divided into four Sub-regions as follows:—

1. The *Malagasy Sub-region*, including Madagascar and its adjacent islands.

2. The *West African Sub-region*, including the great equatorial forest of Central Africa contained in the basins of the western rivers, from the Senegal to the Congo inclusive.

3. The *Cape Sub-region*, including all Africa south of the watershed of the Congo on the West and of the Tana on the East coast.

4. The *Saharan Sub-region*, consisting (if we exclude the Abyssinian plateau) chiefly of desert, or at any rate of a comparatively dry country, including the Sahara, Eastern Africa as far south as the Tana River, and Southern Arabia.

Section IV.—The Malagasy Sub-region

The island of Madagascar is separated from the mainland of Africa by the Mozambique Channel, which, though only about 250 miles across at its narrowest point, is more than 100 fathoms deep throughout its extent.

For our recent knowledge of the fauna of Madagascar we are chiefly indebted to the great work of Grandidier[1] (3). Unfortunately, up to the present time only the plates and a small portion of the letterpress of that part which deals with the mammals have been published.

Out of a total number of forty-seven genera of mammals found in this Sub-region, no less than thirty-three are exclusively confined to it. Of the others, two or three occur also on the mainland of Africa, and the remaining twelve—most of which are bats—are cosmopolitan, or at any rate extend beyond the limits of the Ethiopian Region.

The Ungulates are represented in Madagascar by only one form—a peculiar River-hog (*Potamochœrus*) closely allied to the South African species, but still sufficiently distinct to have earned a title to a separate appellation. With this exception, the Ungulates, so numerous and so conspicuous a feature on the African continent, are entirely absent from Madagascar.

The Rodents are represented in this Sub-region by seven genera of Mice, containing thirteen species, all confined to it.

The Malagasy Sub-region possesses six peculiar forms of

[1] Dr. Forsyth Major's recent explorations in Madagascar have added considerably to our knowledge of its smaller mammals, particularly of Rodents and Insectivores.

FIG. 19.—THE FOSSA.
(*Cryptoprocta ferox.*)

Carnivores, of which the most remarkable is the Fossa or *Cryptoprocta*—a large cat-like animal allied to the Civets, but sufficiently distinct to form a separate family (see Fig. 19, p. 102) according to some authorities. Of the Civets, besides a *Viverricula* closely allied to the Indian Civet, there are six genera with eight species of Mongooses, all confined to the island. Of these the most remarkable is *Eupleres*—a form the jaws and teeth of which are so weak and small, that it was at one time thought to belong to the Insectivora. On the whole, out of the seven genera of Carnivora found in the island, six are absolutely peculiar.

Among the Insectivora of this Sub-region even greater specialisation prevails. Besides two species of ubiquitous shrews (*Sorex*) said to occur there, there are eight genera of this Order found in Madagascar, all of which are confined to the island. *Geogale*, a small mouse-like animal about which little is known, is said to be allied to *Potamogale*, an aquatic otter-like animal found only in Western Africa. The remaining seven genera make up the family *Centetidæ*, the affinities of which are somewhat doubtful, but seem on the whole to approach the Solenodonts, a group confined to the Greater Antilles. The best known of the *Centetidæ* is the Tenrec—the largest member of the order, between twelve and sixteen inches long, and devoid of a tail (see Fig. 20, p. 104). The young of this creature are covered with spines like a hedgehog, but these are lost in the adult state.

The Bats of Madagascar, as would naturally be expected, do not exhibit the great peculiarities found among the other orders of mammals. Out of about twelve genera only one is confined to the island. The distribution of *Pteropus*, the genus of large tropical fruit-eating bats, often

called "Flying-foxes," is interesting. Five members of this genus are found in the Malagasy Sub-region, including two species in the Comoro islands, and although these islands are almost within sight of the mainland of Africa, not a single representative of the true *Pteropus* has yet been obtained on the continent.

FIG. 20.—THE TENREC.
(*Centetes ecaudatus.*)

Finally, among the Lemurs we reach the culminating point of the Fauna of this strange land. No less than eleven genera of this Sub-order are entirely confined to the Sub-region, while outside of it there are only five genera now in existence, two of them belonging to Africa proper, and three to the Oriental Region.

The lemurs are none of them very large; they are all

arboreal animals, spending their lives retired in the forest, and, as a rule, strictly nocturnal. Though allied to the monkeys, they have none of their vivacity and intelligence;

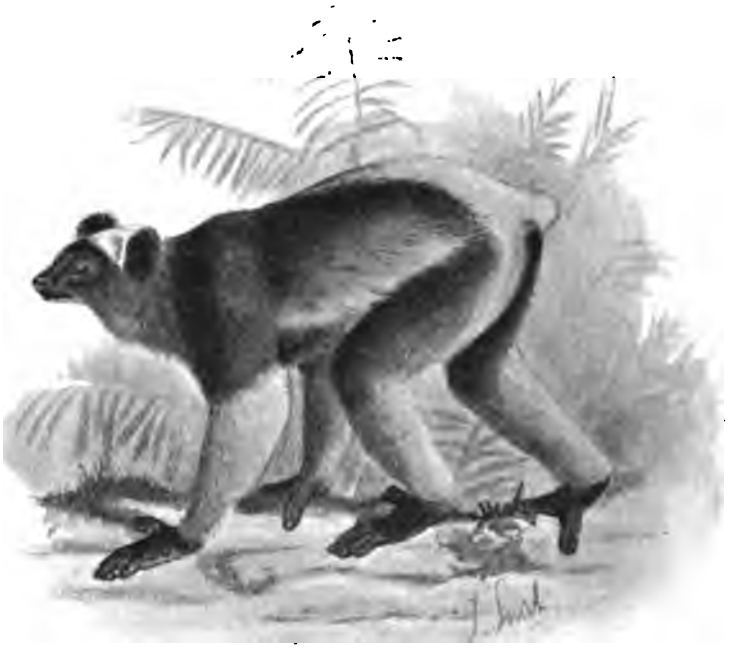

FIG. 21.—THE INDRIS.

(*Indris brevicaudatus.*)

they move but slowly, and have usually very large eyes, which are no doubt necessitated by their nocturnal habits. The lemurs inhabiting Madagascar are divided into two families: (*a*) the *Lemuridæ*, with ten genera and about

thirty-five species, to which family, also, the African and two of the Oriental genera are generally assigned; and (*b*)

FIG. 22.—THE RUFFED LEMUR.
(*Lemur varius.*)

the *Chiromyidæ*. The Indrises (*Indrisinæ*) form a distinct sub-family of *Lemuridæ* with three genera, all re-

stricted to Madagascar (see Fig. 21, p. 105). The typical Lemurs (*Lemuridæ*) are also only found in this island (see Fig. 22, p. 106).

The second family of the Lemurine Order (*Chiromyidæ*) contains only a single genus and species, the extremely

FIG. 23.—THE AYE-AYE.
(*Chiromys madagascariensis.*)

anomalous Aye-aye, discovered by the traveller Sonnerat in 1780 (see Fig. 23). There are generally examples of this curious animal in the Zoological Society's gardens in London, but, unless especially aroused, they are seldom seen by daylight. Their chief peculiarity is the long, thin,

ghost-like middle finger, with which they have been supposed to extract wood-boring insects from their burrows, although their chief food in captivity certainly consists of succulent juices.

Of the extinct mammal-fauna of Madagascar we know as yet too little. Dr. Forsyth-Major (4) has lately described a large lemur (*Megaladapis*) differing considerably from those now inhabiting the island; while remains of two small Lemurs and of two small species of Hippopotamus have been also met with. These remains, together with the bones of a large flightless bird (*Æpyornis*), apparently allied to other Ratite birds, are of a comparatively recent period.

On the whole, however, we cannot but presume that Madagascar originally obtained its animal life from the mainland of Africa. The striking differences between the present faunas of Africa proper and Madagascar are doubtless due to the fact that the great bulk of the existing African fauna is of comparatively modern origin, and came from the Northern continent at the end of the Miocene or the beginning of the Pliocene times, whereas Madagascar was cut off from Africa before this eruption of Northern forms took place. Madagascar, therefore, appears to contain a sample of the ancient Ethiopian fauna, which has been almost exterminated on the mainland, but has survived here under the protection afforded by its separation from the adjacent continent. The fauna of the Malagasy Sub-region may be summarized by the exclusive possession of—

(1) Seven genera of the family *Muridæ*, among the Rodents.

(2) Six genera of the family *Viverridæ*, among the Carnivores.

(3) One genus (*Geogale*) of the family *Potamogalidæ* (shared with the West African Sub-region) and six genera making the whole of the family *Centetidæ*, among the Insectivores.

(4) One genus (*Chiromys*), alone forming the family *Chiromyidæ*, and ten genera of the family *Lemuridæ*, out of a total of fifteen generally recognized.

Almost equally important is the absence of the following groups:—

(1) The orders *Edentata* and *Ungulata* (except *Potamochœrus*).

(2) The families *Sciuridæ* (Squirrels), *Spalacidæ* (Blind Moles), *Octodontidæ*, *Hystricidæ* (Porcupines), and *Leporidæ* (Hares), among the rodents.

(3) The families *Felidæ* (Cats), *Canidæ* (Dogs), and *Mustelidæ* (Weasels), among the Carnivora.

(4) The Primates, other than the lemurs.

The following table shows the number of genera of each order represented in the Malagasy Sub-region and their distribution:—

	Ungulata.	Rodentia.	Carnivora.	Insectivora.	Chiroptera.	Primates.	Total.
Endemic . . .	...	7	6	8	1	11	33
African. . . .	1	...	...	...	1	...	2
Cosmopolitan. .	...	...	1	1	10	...	12
Total .	1	7	7	9	12	11	47

[*N.B.*—The "Endemic" genera are those confined to the Malagasy Sub-region; the "African" genera are those common to Madagascar and the mainland of Africa; and the "Cosmopolitan" genera are those which range beyond the limits of the Ethiopian Region.]

Section V.—The West African Sub-region

The West African Sub-region, as defined above, does not contain nearly so large a proportion of peculiar genera as the Malagasy Sub-region. At the same time, twelve out of a total of eighty genera of mammals that are found within its limits are not met with elsewhere. Moreover, we notice that, as a general rule, the genera inhabiting other parts of Africa are here replaced by distinct species.

The Edentata are represented by one genus, *Manis*, the Scaly Ant-eater. Of the four known African species three are confined to this Sub-region.

Of the Ungulates only one genus is endemic. This is *Hyomoschus*, a very curious aquatic form, which, together with an allied genus found only in the Oriental Region, forms a peculiar Family (*Tragulidæ*) distantly allied to the deer (*Cervidæ*). Many of the genera of Ungulates, however, are here represented by peculiar species. Instances of this are the Liberian Hippopotamus (*Hippopotamus liberiensis*), the Red River-hog (*Potamochœrus penicillatus*), the West African Eland (*Oreas derbianus*), a peculiar species of wild ox (*Bos pumilus*), and several species of Rock-coney (*Hyrax*).

The Rodents do not present any features of special interest, the only peculiar genera being *Deomys* (allied to *Mus*), recently obtained from the Congo district; and the Brush-tailed Porcupine (*Atherura*), of which one species is found only in this Sub-region, and the other two are confined to South-East Asia. Four out of the five known species of the peculiar Rodent-genus *Anomalurus*,

already referred to, are also confined to the West African Sub-region.

Turning now to the Carnivores, there are found in the West African Sub-region only, two remarkable genera, *Poiana* and *Nandinia*. Of these the former is closely allied to the genus *Prionodon*, a beautifully marked civet-like little animal of the Oriental Region, and the latter is akin to the Palm-civets (*Paradoxurus*), also found in the Oriental Region, but not in Africa.

There is only one genus of the Insectivora confined to this Region (*Potamogale*), already alluded to as being probably allied to the Madagascan *Geogale*. This much modified form is one of the few members of the Insectivora that has adopted aquatic habits. It is, for a member of the order, of considerable size.

The Bats of West Africa, as is usually the case in every land, belong mostly to widespread forms. Out of sixteen genera only two, each containing a single species, are confined to this Sub-region, while a third (*Epomophorus*) has not been found outside Africa. These three genera all belong to the family *Pteropodidæ*, which contains the large fruit-eating bats. A few species of Lemurs still survive in the forests of the West African Sub-region. They belong to two genera, neither of which is represented in Madagascar. Of these, one (*Galago*) is also found in the other parts of Africa; the other (*Perodicticus*), containing two species, is met with only in the West African Sub-region.

The forests of West Africa are plentifully supplied with Monkeys. Most of these belong to the genus *Cercopithecus*, of which, out of about forty species, thirty are met with in West Africa. Another enus,

Cercocebus, contains four species, all confined to this Sub-region.

Finally, it is only in these pathless and luxuriant jungles that two man-like apes, the Chimpanzee and the Gorilla, are to be met with. The Gorilla seems to be confined to the Gaboon district, but the Chimpanzee extends all over the Congo basin nearly up to the shores of Tanganyika.

These two, together with the Orangs and the Gibbons of the Oriental Region, make up the family *Simiidæ*, which in structure is the most closely allied to Man of all the Monkeys.

On comparing the West African Fauna with that of the rest of Africa, it will be seen that it is characterized by the exclusive presence of the following forms :—

1. *Hyomoschus* (the Water-chevrotain), which, together with *Tragulus* of the Oriental Region, forms the family of *Tragulidæ* of the Ungulata.

2. Two genera (*Malacomys* and *Deomys*) of the family *Muridæ*, and *Atherura* (Brush-tailed porcupine), found elsewhere only in the Oriental Region, among the rodents.

3. Two genera (*Poiana* and *Nandinia*) of the family *Viverridæ*, among the Carnivora.

4. *Potamogale*, among the Insectivora.

5. Two genera of fruit-eating bats (*Liponyx* and *Trygonycteris*).

6. *Perodicticus*, a genus of Lemurs, and *Cercocebus*, and *Anthropopithecus*, among the higher Monkeys.

The West African Region is further characterized by the absence of the following families, well represented in other parts of Africa: *Orycteropodidæ* (Aard-vark), *Giraffidæ* (Giraffes), *Equidæ* (Zebras and Wild Asses), *Rhinocerotidæ* (Rhinoceroses), and *Leporidæ* (Hares).

The following table shows the approximate number of genera of the West African Sub-region in each order and their distribution:—

	Edentata.	Ungulata.	Rodentia.	Carnivora.	Insectivora.	Chiroptera.	Primates.	Total.
Endemic. . .	0	1	2	2	1	2	4	12
African . . .	0	11	10	2	0	1	4	28
Cosmopolitan .	1	6	8	9	3	13	0	40
Total .	1	18	20	13	4	16	8	80

Section VI.—The Cape Sub-region

This Sub-region, when extended so as to include the whole country as far north as Angola on the west, and up to the Tana river on the east, is on the whole, after the Malagasy, the most distinct of the four Sub-regions, since it possesses nineteen endemic genera out of a total of ninety-one. Furthermore, its area exhibits a greater range of temperature and humidity than the other Sub-regions, for, while in Natal and Mozambique tropical forest-conditions prevail, giving the fauna a certain resemblance to that of West Africa, in Cape Colony itself a temperate and fairly dry climate is found. Again, in Namaqua-land, to the north-west of Cape Colony, we meet with an open, dry, hot, desert country, the conditions of which closely approximate to those of the Saharan Sub-region. The distinctness of this Sub-region, apart from the mammals, is strongly marked by a very remarkable Flora, as well as by the exclusive possession of many forms among the other orders and classes of the animal kingdom. Among the Edentata,

besides the Scaly Ant-eater (*Manis*), of which one species extends as far south-east as the Transvaal, there is also found the Aardvark (*Orycteropus*), an animal characteristic of South Africa, though also occurring in East Africa as far north as the upper Nile basin. The relationships of this creature are very obscure, but the recent discovery of remains of a closely allied fossil form in beds of lower Pliocene age in the island of Samos, in the Ægean Sea, shows that the Aardvark, like so many other African animals, has migrated southwards from the Palæarctic Region.

The greater number of the genera to which the numerous Antelopes of the Cape Sub-region belong, extend northwards into the Saharan and even into the West African Sub-region, although the species of the Cape Sub-region are in many cases distinct.

Among the distinct species may be mentioned the Hartebeest (*Bubalis caama*), the Spring-bok (*Antidorcas euchore*), and the Sable Antelope (*Hippotragus niger*). The two Gnus (*Connochætes*) and the Pallah (*Æpyceros*) are confined to this Sub-region. To the portion of this Sub-region south of the Zambesi are restricted two of the African horses, the Quagga (*Equus quagga*), now said to be extinct, and the Mountain Zebra (*Equus zebra*), which is fast approaching the same condition. But Burchell's Zebra (*Equus burchelli*), under various slight modifications, occurs in suitable localities throughout the whole Sub-region.

The White or Square-lipped Rhinoceros (*Rhinoceros simus*), which now only exists in two small districts of Mashonaland and Zululand, was formerly abundant in the Cape Colony and the Transvaal, but has never been met with north of the Zambesi.

Five out of the eighteen genera of Rodents found in this Sub-region are endemic. Two of these belong to the Mouse-family (*Muridæ*), and two more to a burrowing family (*Spalacidæ*); the fifth (*Petromys*) belongs to the family *Octodontidæ*, which the Ethiopian shares with the Neotropical Region.

The South African Sub-region, however, is especially remarkable for the large number of peculiar genera of Carnivora. Five of these genera have been formed for the reception of a number of small animals allied to the Indian Mongoose. Another, for which a separate family has been created, contains only the Aard-wolf (*Proteles*), an animal nearly allied to the hyenas, but with very small and rudimentary teeth, and a heavy mane of long hair. It is nocturnal, and feeds principally on carrion, being too weak to attack other living animals. The *Otocyon*, or Cape Hunting-dog, which constitutes another peculiar genus, is remarkable for having a greater number of molar teeth than any other mammal. Owing to this, it has been regarded by Professor Huxley as the most primitive of all existing members of its Family. Out of the six genera of Insectivora found in this Sub-region three are endemic. Of these the most interesting is the genus *Chrysochloris*, which forms a distinct Family, and comprises no less than eight species. These animals are sometimes known as "Golden Moles," owing to the brilliant metallic lustre of their fur. They are in some respects allied to the *Centetidæ*, a family mentioned above as confined to Madagascar; but they are modified for a burrowing life, and externally resemble the Moles. Neither of the two remaining Orders, the Bats and the Monkeys, is represented by peculiar genera in the Cape Sub-region. This, however, is quite

what one would expect, as members of these two Orders are essentially forest-loving in their habits, and this Sub-region consists chiefly of sparsely wooded and arid districts.

On the whole, therefore, the Cape Sub-region will be found to be characterized, as compared with other parts of Africa, by the exclusive possession of the following forms:—

1. *Connochætes* (the Gnu), *Pelea* (the Rhébok) and *Æpyceros* (the Pallah) among the Antelopes.

2. *Pachyuromys* and *Mystromys*, genera of *Muridæ*; *Bathyergus* and *Myoscalops*, genera of the burrowing *Spalacidæ*; *Petromys* of the *Octodontidæ*, among the Rodents.

3. Five genera of Mongooses, belonging to the family of *Viverridæ*; *Proteles*, the only representative of the family *Protelidæ*; *Otocyon* (the Cape Hunting-dog); and *Pœcilogale* (a small weasel), among the Carnivora.

4. *Rhynchocyon*, of the *Macroscelidæ*; *Myosorex* (a Shrew); and the *Chrysochloridæ* (Golden Moles), among the Insectivora.

The following table, showing the distribution of the genera, is constructed on the same plan as that of the other Sub-regions.

	Edentata.	Ungulata.	Rodentia.	Carnivora.	Insectivora.	Chiroptera.	Primates.	Total.
Endemic. . .	0	3	5	8	3	0	0	19
African . . .	1	15	6	3	0	2	4	31
Cosmopolitan .	1	8	7	9	3	13	0	41
Total .	2	26	18	20	6	15	4	91

Section VII.—The Saharan Sub-region

The Saharan Sub-region, as its name implies, is essentially a dry and desert district. As here regarded, in addition to the Sahara proper, it includes the southern part of Arabia and Somaliland, both of which are distinctly arid countries. The only part of the Sub-region where there is much rainfall is in the Abyssinian highlands and the country surrounding such isolated mountains as Kenia. In consequence of these facts, and also in accordance with the fact that the Sub-region is conterminous for so long a distance with the Palæarctic Region, the number of endemic genera of the Saharan Sub-region is extremely small, being only seven out of a total of eighty-five—that is, 8 per cent. as compared with 21 per cent. in the Cape, and 15 per cent. in the West African Sub-region.

Of recent years a considerable number of new forms, especially of Antelopes, have been obtained from Somaliland, a country which, up to a few years ago, was quite unknown, and it is quite possible that eventually the "unknown Horn of Africa" will be found to possess a Fauna sufficiently distinct from the rest of the continent to be separated as another Sub-region. But for the present, until our knowledge is widened a little more, it will be best to keep Somaliland in the Saharan Sub-region.

The most characteristic feature of the Sub-region is, perhaps, the large numbers of Antelopes. These, as a rule, are specifically distinct from those of the Cape Sub-region. Among them may be mentioned Swayne's Hartebeeste (*Bubalis swaynei*), Hunter's Bontebok (*Damaliscus hunteri*), three species of *Oryx* (*O. beisa* from Abyssinia

and Somaliland, *O. beatrix* from Arabia, and *O. leucoryx* extending from Senegal to Nubia), and a distinct species of Kudu (*Strepsiceros imberbis*), which inhabits the Sub-region from Somaliland as far south as the Tana. This Sub-region is also the headquarters of the Gazelles (*Gazella*), at least twelve species out of a total of twenty-five being found there.

Three genera of antelopes are endemic; these are the Dibatag (*Ammodorcas*), and the Gerénuk (*Lithocranius*), both found in Somaliland, and remarkable for their very long necks, by means of which they are enabled to reach down branches of trees from a considerable height. The third is the Addax (*Addax*), which is found throughout the Sahara, and extends into Arabia.

The Rodents are well represented in this Sub-region, but there are only three peculiar genera—*Lophiomys*, *Heterocephalus*, and *Pectinator*.

Lophiomys, a curious crested Rodent, forms a distinct family. The remarkable little animal *Heterocephalus* is almost entirely hairless, and apparently lives underneath the ground, burrowing in the soft sandy soil of the desert. It was originally obtained by the celebrated traveller Rüppell in Abyssinia, and has since been brought from the interior of Somaliland by Mr. Lort Phillips.

The third endemic genus, *Pectinator*, is also from the coast of Somaliland and Abyssinia. It was first obtained by Captain Speke, and named by Blyth (*P. spekei*) after its discoverer.

The Saharan representatives of the Carnivora, Insectivora, and Bats are almost all widespread forms, and present no features of special interest. Among the Monkeys, however, we find one peculiar genus—this is

Theropithecus, containing two species of terrestrial baboons, which inhabit Abyssinia and the Galla country.

The other genera of African monkeys are fairly represented here, though by no means so abundantly as in the West African Sub-region.

The Saharan Sub-region, therefore, is characterized by the exclusive possession of the following genera:—

(1) *Ammodorcas*, *Lithocranius*, and *Addax* among the antelopes.

(2) *Lophiomys* (forming a distinct family), *Heterocephalus*, and *Pectinator* among the rodents.

(3) *Theropithecus* among the Monkeys.

The following families, found in other parts of Africa, are absent from this Sub-region: *Tragulidæ* (chevrotains), *Protelidæ* (aard-wolf), *Potamogalidæ* (river-shrews), *Chrysochloridæ* (golden moles), and *Simiidæ* (the anthropoid apes).

The following is the summary of the mammals inhabiting the Saharan Sub-region:—

	Edentata.	Ungulata.	Rodentia.	Carnivora.	Insectivora.	Chiroptera.	Primates.	Total.
Endemic. . .	0	3	3	0	0	0	1	7
African . . .	1	15	8	3	0	1	4	32
Cosmopolitan .	1	9	12	7	3	14	0	46
Total .	2	27	23	10	3	15	5	85

Section VIII.—The Past History of the Ethiopian Mammal-fauna

Up to the present time palæontology has afforded us little assistance in tracing out the past history of the African Mammal-fauna. With the exception of a few still

surviving species found in a semi-fossil condition in caves, the only fossil mammal hitherto obtained from the Ethiopian Region is a form named by Owen *Tritylodon*, the remains of which were discovered in the Karoo beds of Basutoland, in South Africa. This formation is of Mesozoic age, and seems to correspond to the Trias of Europe. Near Stuttgart, also, in beds of the Trias age, another specimen closely resembling that of South Africa has been obtained. *Tritylodon* belongs to a group which was apparently allied to the modern Marsupials, and many somewhat similar forms have been found in other Mesozoic beds in Europe and North America.

The only conclusion to be drawn from this is, that before the commencement of the Tertiary epoch the whole world was, so far as is at present known, inhabited by small insignificant mammals distantly allied to the Marsupials, which are at present restricted to Australia and South America. Besides *Tritylodon*, the only fossil mammals hitherto known, from the Ethiopian Region, are those which have been described by Grandidier (3) and Forsyth-Major (4) from Madagascar, as mentioned above.

The resemblances between the Faunas of the Oriental and Ethiopian Regions have been noted and commented on by many writers; Mr. Allen is even disposed to join the two Regions into one realm. The number of prevailing genera, however, common to these two Regions, and not found in the Palæarctic Region, is very small, the total being, as was pointed out in the first article of this series, only eight, and of these one (*Mellivora*) has since then been recorded by Büchner (2) as occurring in the Trans-Caspian district, and is therefore also Palæarctic. Of the other seven, four have been found, in a fossil state, in

various parts of the Palæarctic Region. These are—(*a*) *Manis* (the Scaly Ant-eater), from the Pliocene of Samos; (*b*) *Rhinoceros*, which existed in various parts of Europe from the Miocene up to the Pleistocene times; (*c*) *Elephas*, which first appears in Pliocene times, and extends to late Pleistocene in Europe; and (*d*) *Viverra*, which commences earlier than the others, and also survived until Pliocene times in Europe. The three remaining genera common to India and Africa, but not hitherto found in fossil state in the Palæarctic Region, are *Golunda* (a Rat), *Atherura* (a Porcupine), and *Nycteris* (a small insectivorous Bat).

It is quite possible that these animals may eventually be discovered in the European Tertiaries. Besides this, the remains of a considerable number of the now endemic African genera have been found fossil in Europe. The list of these is instructive, and points almost unquestionably to the conclusion that Africa has been gradually peopled by successive inroads of animals from the North.

In the Eocene beds of Europe the still existing genera are few in number; but the Lemurs, and many of the more primitive forms of the Carnivora, such as form the present fauna of Madagascar, abound. It is, therefore, probable that the separation of Madagascar from the mainland of Africa took place at about the close of the Eocene period. During the Miocene and lower Pliocene times in Europe, a large number of new genera appear for the first time, the bulk of which still survive in Africa and India, though extinct or almost driven out of the Palæarctic Region.

Examples of such genera are—*Orycteropus*, the Aardvark; *Manis*, the Scaly Ant-eater; *Rhinoceros; Hyomoschus*, the Water-Chevrotain (probably identical

with *Dorcotherium*, a fossil form); *Giraffa;* several genera of Antelopes; the Porcupine; the Squirrel; *Felis; Hyena; Viverra; Herpestes*, and even the higher Monkeys.

It must have been during this period that broad land-connections existed between Europe and Africa, by means of which the African continent became peopled by its present fauna.

In the succeeding Pliocene times in Europe, although a number of the more distinctly African forms still survive, there begin to appear certain genera, such as those of the Deer-family (*Cervidæ*), *Ursus* (the Bear), and others which have never reached Africa at all. This seems to show that Africa was, at the commencement of this period, cut off from the Palæarctic Region by an intermediate sea.

LIST OF THE PRINCIPAL AUTHORITIES REFERRED TO IN CHAPTER IV.

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(2) BÜCHNER, E.—"Ueber das Vorkommen der Mellivora indica, Kerr, im Transcaspi-Gebiet." *Notes Leyd. Mus.*, xv., p. 99.

(3) GRANDIDIER, A.—"Histoire Physique, Naturel et Politique de Madagascar," vol. x., *Mammifères*, by Milne Edwards and Grandidier, 1890.

(4) MAJOR, C. I. FORSYTH—"On Megaladapis madagascariensis, an extinct gigantic lemuroid." *Proc. Roy. Soc.*, 1893, p. 176.

(5) NEUMANN, B.—"Bericht über seine Reisen in Ost und Central Afrika." *Verhandl. Gesellsch. Erdkunde Berlin*, 1895 (p. 24 in separate copy).

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CHAPTER V

THE ORIENTAL REGION

(PLATE V., p. 152)

SECTION I.—BOUNDARIES OF THE ORIENTAL REGION

THE Oriental is the smallest of the six Regions into which the Earth has been divided for the study of zoological distribution. On the west it includes the great peninsula of India and its attendant island of Ceylon. Its boundary on this side is probably the Suliman range of hills, though the fauna of Western Sind and the Punjab, which lie between that range and the Indus, is intermediate in character between those of the Oriental and Palæarctic Regions. Beyond this range the boundary runs eastwards along the slopes of the Himalayas, at an elevation of from 9000 to 10,000 feet above the sea-level. Above this height Palæarctic forms are chiefly met with, below it Oriental forms mostly prevail. Eastwards of Sikkim the boundary between the Palæarctic and Oriental Regions cannot be laid down with certainty, owing to our little acquaintance with the eastern part of Tibet and the adjacent portion of China. What knowledge we have of the fauna of this Region is due almost entirely to the celebrated French missionary, Père David, who made considerable researches in Moupin, a small mountainous territory, situated at the extreme western edge of the Tibetan plateau. Père David's collections have been mostly described by M.

Milne-Edwards (1). An examination of the list of the mammals obtained by him in this district shows that the fauna has a character intermediate between those of the Oriental and Palæarctic Regions, besides containing a considerable proportion of peculiar forms. As, however, most of the Oriental genera extend even further north into the Chinese province of Kansu, and some even cross into Japan, countries which are otherwise well within the Palæarctic Region, it will be most convenient to draw the boundary of the Oriental Region to the south of Moupin. Beyond this point again our knowledge of the distribution of the mammals is very scanty, and though the northern part of China appears to be distinctly Palæarctic, and the southern Oriental in its affinity, there is, so far as we know, a considerable admixture of forms all over this part of Asia. Probably the most convenient boundary will be found to be that adopted by Wallace—the northern edge of the basin of the Yang-tze-Kiang. This is, no doubt, to a great extent an artificial boundary, but such a fault is unavoidable in the present instance, as there is here no natural frontier to separate the two regions. In addition to the south-eastern part of Asia, the Oriental Region includes within its boundaries all the large and important islands lying between that continent and the Australian Region. The principal of these are the Chinese islands of Formosa and Hainan, the large group of the Philippines, together with Sumatra, Java, Borneo, and the adjacent islands up to Wallace's Line. With the exception of Celebes, all these islands are truly continental in character—that is to say, are separated from the mainland by seas of less than 100 fathoms of depth. But Celebes is in some respects anomalous, and will be considered in greater detail below.

The boundary between the Australian and the Oriental Regions called Wallace's Line, as having been first pointed out by that distinguished naturalist, runs between the two small islands of Bali and Lombok. Bali is connected by shallow water, and also by its zoological relationships, with Java; while Lombok agrees in character with Timor and the other Australian islands further east. From Bali the boundary of the Oriental Region runs in a north-eastward direction, between Celebes on the one side and the Sula islands and Gilolo on the other.

Section II.—General View of the Mammal-fauna of the Oriental Region

The Oriental Region lies almost wholly within the tropics. The greater part of the country within its borders enjoys a bountiful rainfall, and is covered with luxuriant forests; the only portion which is less favoured being the north-western part of India and the strip of country along the northern shores of the Persian Gulf. In these districts there is very little rain, and desert conditions and a desert Fauna, somewhat resembling those of the African Sahara, prevail.

The Fauna of the Oriental Region presents, on the whole, a striking contrast to that of the Australian Region. The characteristic features of the latter are doubtless due to the long isolation to which it has obviously been subjected, whereas the Oriental Region as regards its characteristic forms is more nearly allied to the neighbouring Palæarctic Region, from which probably most of its inhabitants have been derived.

The Oriental Region contains representatives of eight out of the nine Orders of terrestrial mammals, the Monotremes alone being wholly absent, while the Mar-

FIG. 24.—THE NYLGHAIE.

(*Boselaphus tragocamelus.*)

supials are barely represented by two species of *Cuscus* (Phalanger) found only in the island of Celebes, which have been obviously derived from the neighbouring Australian Region.

The Edentates, like the marsupials, are also represented by one genus only, *Manis* (the Pangolin), which the Oriental shares with the Ethiopian Region.

The Oriental further resembles the Ethiopian Region in the variety of its forms of Ungulates, although they are not

FIG. 25.—THE GAYAL.
(*Bibos frontalis.*)
[*P. Z. S.* 1890, p. 595.]

nearly so abundant. Three genera of Antelopes, the Four-horned Antelope (*Tetraceros*), the Black-buck (*Antilope*), the Nylghaie (*Boselaphus*), (see Fig. 24, p. 126), are peculiar to it, as is also a group of wild Oxen (*Bibos*), with three species—the Gayal (Fig. 25), the Gaur, and the Banting.

But while the Rhinoceroses, the Wild Asses, the Elephants, and the Antelopes are common to both the Oriental and Ethiopian Region, the Oriental possesses in addition Deer,

FIG. 26.—THE BINTURONG.
(*Arctictis binturong.*)

Wild Sheep, and Wild Goats. These three last-named groups have never established themselves in the Ethiopian Region, though a single goat (*Capra walie*) has penetrated

as far as the highlands of Abyssinia. But representatives of all of them are found in the Palæarctic Region.

Among the Rodents of the Oriental Region the Squirrels are especially numerous, there being upwards of fifty species found within its limits, nearly all of which are arboreal in their habits.

Although there are no families of Carnivores peculiar to the Region, there is a considerable number of genera of Civets (*Viverridæ*) not found elsewhere, such as the Paradoxures (*Paradoxurus*) the Binturong (*Arctictis*) (Fig. 26, p. 128), and the genera *Prionodon*, *Arctogale*, and *Hemigale*. The Bears (*Ursidæ*), too, which are quite unknown in Africa, are characteristic members of the Oriental Mammal-fauna.

Among the Insectivores we find two peculiar families. One of these has been formed for the reception of *Galeopithecus*, the so-called Kaguan, an animal of about the size of a small cat, with thin flaps of skin between the fore and hind limbs and tail, which enable it to make flying leaps from tree to tree (see Fig. 27, p. 130). The other family (*Tupaiidæ*) contains two genera. One of these, *Tupaia*, with at least twelve species, is an abnormal Shrew with a curious external resemblance to the Squirrels, with which, however, it has no real connection. The other, *Ptilocercus*, is distinguished from *Tupaia* by its peculiar tail, which is provided at the end with a bilateral fringe of long hairs. Both these families are confined to the Malayan portion of the Oriental Region.

Bats are numerous in the Oriental Region, and many of the genera extend eastwards into the Austro-Malayan islands. Only four genera, each with a single species, are peculiar.

Finally, among the Primates there are three genera of Lemurs. Two of these (*Nycticebus* and *Loris*) are peculiar,

FIG. 27.—THE KAGUAN.

(*Galeopithecus volans.*)

but belong to the family *Lemuridæ*, and have their nearest allies in Africa. The third (*Tarsius*), which forms a family

of itself, is practically confined to the Region, although it has slightly overstepped its boundaries, being said to occur in one of the smaller Austro-Malayan islands between Sumba and Timor. Besides the Lemurs, six genera of true Monkeys are found in the Oriental Region. Three of these, the Proboscis Monkey of Borneo (*Nasalis*), the Gibbons (*Hylobates*), and the Orangs of Sumatra and Borneo (*Simia*), are strictly endemic; while the other three, although highly characteristic of this Region, have extended their range slightly across its frontiers.

Summarizing these results, we shall find that the Oriental Region contains only two truly endemic and one quasi-endemic families out of a total of thirty-six which occur within its limits. These are the *Galeopithecidæ* (Flying Lemurs), *Tupaiidæ* (Tree shrews), and *Tarsiidæ* (Tarsiers).

The total number of genera found in the Region is 113, out of which 38 are peculiar; 11 extend their ranges slightly beyond the limits of the Region, and 64 are widely spread. On reducing these figures to an average, it will be found that the Oriental Region contains about 38 per cent. of peculiar genera, or, if the quasi-endemic genera be added, about 45 per cent. In either case, this shows a much lower percentage of peculiarities than has been shown to exist in the three Regions previously considered.

Section III.—Subdivision of the Oriental Region

The Oriental Region, as regards its mammals, may be most conveniently divided into four Sub-regions (see Map, Plate V., p. 152). These are:—

1. The *Indian Sub-region.*—This comprises the whole

of India proper from the Suliman range and the lower slopes of the Himalayas to Cape Comorin. A line drawn northwards from Calcutta to the Himalayas, forms the approximate eastern boundary between this Sub-region and the next. There should also be included in this Sub-region the island of Ceylon, and probably the narrow, low-lying strip of desert country between the Persian Gulf and the central plateau of Persia.

2. The *Burmo-Chinese Sub-region.*—This Sub-region includes the portion of Sikkim below 10,000 feet, Assam, China south of the northern water-parting of the Yang-tze-Kiang, the islands of Formosa and Hainan, and all the countries of the Indo-Chinese peninsula (Cochin China, Siam, and Burma), its southern land-boundary being approximately a line running to the north of the Malay peninsula from Tavoy on the west, to Bangkok on the east, at about 15° N. lat.

3. The *Malayan Sub-region.*—The Malay peninsula, together with the great islands of the East Indian archipelago, Sumatra, Java, Borneo, and the Philippines, forms a third division, which may be called the Malayan Sub-region.

4. The *Celebesian Sub-region*, containing only the island of Celebes.

This subdivision of the Oriental Region differs from that adopted by Wallace in two important points:—

(*a*) In the combination of Wallace's Indian and Ceylonese Sub-regions into one—the Indian Sub-region.

(*b*) In the transference of Celebes from the Australian to the Oriental Region, and the formation of a new Sub-region for its reception.

The reasons for these changes may be here briefly considered. First, as regards Ceylon, there are nineteen

genera of mammals found in the Indian Sub-region, which do not extend their range further eastwards into the Burmo-Chinese Sub-region. Of these, thirteen are to be met with also in the Palæarctic and Ethiopian Regions, leaving only six confined to the Indian Sub-region. These six are—

(1) *Tetraceros* (Four-horned Antelope).
(2) *Antilope* (Black Buck).
(3) *Boselaphus* (Nylghaie).
(4) *Platacanthomys* (Spiny Rat).
(5) *Melursus* (Indian Bear).
(6) *Loris* (Slender Lemur).

Of these, *Loris* alone is characteristic of Southern India and Ceylon (the Ceylonese Sub-region of Wallace). *Melursus* is found in Ceylon, but occurs also all over the peninsula of India from the Himalayas southwards. *Platacanthomys* inhabits the western Ghats and the Animali hills of Southern India alone, and not Ceylon; the remaining three genera are distributed over the whole of the Indian peninsula, but do not reach Ceylon.

There is, therefore, only one genus of mammals confined to the Ceylonese Sub-region of Wallace, and this hardly seems to afford an adequate reason for separating it from the Indian Sub-region proper. The chief ground for so doing, according to Mr. Wallace, is the existence there of a peculiar family of snakes—the *Uropeltidæ*, or Rough-tails, which are entirely confined to Wallace's Ceylonese Sub-region. Examples of these reptiles, however, have been recorded in India as far north as Ganjam, in 20° N. lat., and it seems probable that they may eventually be found all over the peninsula south of the great plains of the Indus and the Ganges.

Secondly, as regards Celebes, this island certainly

presents a difficult problem to the student of geographical distribution. But so far as the mammals are concerned, the only Australian element in Celebes consists of two species of Phalanger and a few Bats; the remaining forms, although many of them are very peculiar, have been, doubtless, originally derived from the Oriental rather than from the Australian Region. It seems more logical, therefore, on the whole, to make the island of Celebes a separate Sub-region of the Oriental rather than of the Australian Region. This position, however, will be considered in greater detail in the account of the Sub-regions.

Section IV.—The Indian Sub-region

The Indian Sub-region has a close resemblance to the Palæarctic Region. This is more especially the case in the north-western districts, where the country is practically rainless, and the fauna, owing to similarity of condition, is in many respects closely allied to that of the neighbouring desert regions of Central Asia. The desert district of the Indian Sub-region includes the narrow strip of coast land to the north of the Persian Gulf, the Punjab, Rajputana, and the northern part of the Bombay Presidency. The greater part of the peninsula of India south of the great plains is occupied by the high, and rather dry, plateau of the Deccan and of Central India, which is covered with a thin and scanty jungle. The southern slopes of the western Ghats and the greater part of Ceylon enjoy an abundant rainfall, and are clothed with a tropical forest, in consequence of which their faunas present many points of resemblance both to each other and also to that of the Malayan Sub-region, which has similar physical conditions.

Our knowledge of the mammals of this and the next Sub-region is very fairly complete, owing to the excellent handbook recently published by Mr. W. T. Blanford (2).

The Pangolin (*Manis*), which, with slight specific modifications, is also found in all the other Sub-regions as well as in the Ethiopian Region, is here the sole representative of the Edentates. The Sub-region is well provided with members of the various families of Ungulates. Three peculiar genera of Antelopes, which are not found beyond the limits of the Sub-region, have been already mentioned; other genera, such as the Gazelles (*Gazella*), the Goats (*Capra*), and the Sheep (*Ovis*), are found in other parts of the world as well as in this Sub-region, but are absent from the remaining Sub-regions.

All the families of Ungulates are common to this and the Ethiopian Region, except the Deer-family (*Cervidæ*), the entire absence of which from Africa south of the Atlas has already been commented upon.

The Rodents do not present any marked features of interest in this Sub-region. One genus, *Platacanthomys*, a small dormouse-like member of the family *Muridæ*, is found only in the hills of Southern India, otherwise the genera are mostly wide-spread forms.

Among the Carnivores the Cats are numerous and large. This Sub-region is the proper home of the Tiger, which, however, has extended itself throughout the whole Region, and even across its boundaries westwards into Persia and Trans-Caspia, and eastwards far into China and Manchuria. The Lion, too, which is essentially an animal haunting dry and comparatively barren countries, is a member of this division of the Indian fauna. It was formerly much more abundant in the peninsula, but

is now, apparently, restricted to a small area in Western India.

As is the case with the Ungulates, so here, with the exception of the Bears (*Ursidæ*), all the families of Indian Carnivores also range into Ethiopia.

The Insectivores of this Sub-region need not detain us long. A Tree-shrew (*Tupaia*), an outlying member of a genus very abundantly represented in the Malay countries, is found in Southern India; the other genera, the Hedgehogs (*Erinaceus*) and the Shrews (*Crocidura*), are widely spread throughout the Old World.

Among the Bats of this Sub-region we find that not only there are no peculiar genera, but that even the species in nearly all cases have an extended range beyond its limits. Out of about forty species, six alone are confined to the Sub-region.

The Slender Loris is found only in Southern India and Ceylon, and is the single representative of the Lemurs in this Sub-region. It is a strange-looking creature, with long spidery arms and no tail. Like most of its race, it is arboreal and nocturnal in its habits.

Indian monkeys all belong to the two large genera, *Macacus* and *Semnopithecus*, both of which are characteristic of the Oriental Region, although two or three species of them have strayed over the borders into the Palæarctic Region.

The following table shows, in a succinct manner, the origin and distribution of the mammals of this Sub-region. The species in the first line, reckoned as "Endemic," are confined to the Sub-region; those called "Oriental" do not occur beyond the boundaries of that Region; those catalogued as "Palæarctic" are common to that Region

and to the Indian Sub-region; the "Ethiopian," in the same way, are found alike in the Ethiopian Region and the Indian Sub-region. The "Palæogean" genera are those which are found in the Indian Sub-region and in more than one of the other three Regions of the Old World. Finally, the "Cosmopolitan" genera are those found in the New World as well as in the Old.

	Edentata.	Ungulata.	Rodentia.	Carnivora.	Insectivora.	Chiroptera.	Primates.	Total.
Endemic	0	3	1	1	0	0	1	6
Oriental	0	1	1	1	1	0	0	4
Palæarctic	0	1	2	1	0	0	2	6
Ethiopian	1	2	1	2	0	0	0	6
Palæogean	0	4	4	4	2	12	0	26
Cosmopolitan	0	3	3	5	0	3	0	14
Total	1	14	12	14	3	15	3	62

From this table it will be seen that the relations of the Indian Sub-region are about equally divided between the Palæarctic and Ethiopian Regions; the largest number of genera are registered as "Palæogean," and most of these are common to the three Regions of the Old World. The relations of this Sub-region to the Australian Region are very slight; with the exception of *Canis*, it is only among the Bats that we find any common genera.

Section V.—The Burmo-Chinese Sub-region

Owing to our imperfect knowledge of the fauna of the central part of China and of Tibet, it is impossible at present to draw up a complete list of the mammalian

genera inhabiting this Sub-region, and it is consequently out of the question to lay down anything but a very uncertain boundary between this Sub-region and the neighbouring Palæarctic Region. It is probable, however, that even when Western China and Tibet have been thoroughly explored, it will still be difficult to trace an absolute frontier between the Palæarctic and Oriental Regions. As we already know, Northern China and Japan contain a considerable number of purely Oriental species. Even the Tiger, usually associated with tropical jungles, ranges through China into the valley of the Amoor and the island of Saghalien, where a most severe Arctic winter is met with. In the same way, two species of a typically Oriental genus of Monkeys are found in North-East Asia—one (*Macacus speciosus*) in Nipon, the largest of the Japanese group of islands; the other (*Macacus tcheliensis*) in the mountains north of Pekin.

On the other hand, a good many purely Palæarctic forms extend into Southern China. This is more especially the case among the birds, which have hitherto received a preponderating share of the attention of the naturalists and collectors in the Chinese Empire.

Passing over the Edentates, represented, as in the Indian Sub-region, by two species of Pangolin (*Manis*), we come to the Ungulates of the Burmo-Chinese Sub-region. Here we remark the disappearance of the Antelopes, and the great development of the Deer-family (*Cervidæ*), of which no less than fifteen species are found in this Sub-region. One of these (*Elaphodus*) is a curious little Deer with very small simple antlers and large canine teeth; it was first described by Milne-Edwards from Western Tibet, and subsequently a second species of the same genus was

discovered in Southern China. Another small Deer, for which a separate genus (*Hydropotes*) has been rightly formed, has no trace of antlers at all, and in other respects differs much from the remaining members of the family. This form is entirely confined to Southern China. A third peculiar genus, belonging to the *Bovidæ*, is the Takin (*Budorcas*). This ox-like Antelope is also found in Western Tibet, but extends its range southwards to the Mishmi country in the north of Assam. The Takin is one of the very few of the larger ruminants that has never been met with or shot by European sportsmen, and our knowledge of it is entirely derived from the natives.

The Burmo-Chinese, like the Malayan Sub-region, is the most frequented haunt of the Squirrel family (*Sciuridæ*). No less than thirty-two species, referable to the genera *Sciurus* (the true Squirrel) and to *Pteromys* and *Sciuropterus*, the Flying Squirrels, are found here alone. The only Rodent supposed to be truly endemic is *Hapalomys*, a long-tailed Rat found in Burma.

The Burmo-Chinese Carnivores do not call for any special remark; one genus alone (*Helictis*) is strictly endemic. It contains three or four species of small badger-like animals with arboreal habits.

Among the insectivores of this Sub-region only one genus is endemic. This is *Soriculus*, containing some small shrew-like mammals found only in Sikkim and Assam. Several species of Mole (*Talpa*), as also *Anurosorex*, and *Chimarrhogale*, belonging to the Shrew family (*Soricidæ*), extend from the Palæarctic Region into this Sub-region, but no farther.

The Bats of Burmo-China need not detain us long; most of the genera are widely spread, and a very large

number of them extend across Wallace's line into the Austro-Malayan islands—a distribution shared by hardly any other of the Oriental genera of mammals.

One of the Slow Lemurs, *Nycticebus*, is common to this and the Malayan Sub-region; it bears a certain resemblance to the Indian genus *Loris*, but is distinguished by its somewhat stouter aspect and its still more sluggish habits.

Among the Monkeys of this Sub-region, in addition to the two genera *Macacus* and *Semnopithecus*, inhabiting also the Indian Sub-region, a genus of the anthropoid Apes occurs. This is *Hylobates*, members of which are commonly known as Gibbons; they are slender animals, with very long limbs and no tail, and are entirely restricted to the forest districts, being exclusively arboreal in their mode of life.

The following summary of the Burmo-Chinese genera of mammals has been drawn up exactly in the same way as the previous list, except that under an additional heading, "Australian," are placed two genera common to the Oriental and Australian Sub-regions:—

	Edentata.	Ungulata.	Rodentia.	Carnivora.	Insectivora.	Chiroptera.	Primates.	Total.
Endemic	0	1	1	1	2	0	0	5
Oriental	0	0	1	4	3	2	2	12
Palæarctic	0	4	1	3	3	1	2	14
Ethiopian	1	2	1	2	0	1	0	7
Australian	0	0	0	0	0	2	0	2
Palæogean	0	1	3	1	1	11	0	17
Cosmopolitan	0	3	3	6	0	3	0	15
Total	1	11	10	17	9	20	4	72

Section VI.—The Malayan Sub-region

The Malayan Sub-region lies entirely within the tropics, and almost the whole of it is covered with a luxuriant tropical jungle. It is here, consequently, that we find the Oriental fauna in its highest state of development, and with the least admixture of forms belonging to other Regions. With the exception of the Malay Peninsula, the whole of this Sub-region consists of islands, which, however, are separated from the main continental mass by comparatively shallow water, so that an elevation of 100 fathoms would obliterate the whole of the sea between the various islands, leaving them connected with one another and with the Asiatic continent. There can be no doubt that these islands, all of which have very rich faunas, have been stocked from the mainland, and that a careful study and comparison of their component parts would go far to enable us to trace out the past history of the Region, and to find out what changes have taken place from time to time in the distribution of land and sea.

If a careful analysis of the mammalian genera of the Sub-region be made, it will be found that the greater number of the genera found on the mainland extend to all the three larger islands, Sumatra, Java, and Borneo, and that of the remaining genera the larger proportion are common to the Malay Peninsula, Sumatra, and Borneo, and are not found in Java. This would seem to indicate that Java was separated from the mainland before Sumatra and Borneo, and this view is further borne out by the fact that individual species of a genus are frequently common to the Malay Peninsula, Sumatra, and Borneo,

whereas in Java they are replaced by slightly different forms. The Philippines, though connected with Borneo by two chains of islands, so that the straits separating the group from Borneo are nowhere very wide, contain a poor mammal-fauna as compared with Borneo. Only about fourteen genera, exclusive of bats, have reached these islands, and, with one exception, these are all widespread. But it must be recollected that the Mammal-fauna of the Philippines is still very imperfectly known.

The following table gives the figures relating to the distribution of the genera within the Sub-region (excluding bats):—

Number of genera that occur in—

(1) The Malay Peninsula, Sumatra, Borneo, and Java .	36
(2) The Malay Peninsula, Sumatra, and Borneo . .	6
(3) The Malay Peninsula and Borneo alone . . .	3
(4) The Malay Peninsula, Sumatra, and Java . . .	2
(5) The Malay Peninsula and Java alone . . .	1

As regards the Philippines, the total number of mammal genera (exclusive of bats) is fourteen, thirteen of which occur also in the Malay Peninsula and islands; one is confined to the Philippines alone; in addition five Malayan genera reach Palawan, a large island lying between Borneo and the Philippines.[1]

Although the Malayan Sub-region does not contain any endemic genera of Ungulates, there is one form the distribution of which is so remarkable that special attention must be drawn to it. This is the Tapir, one species of

[1] This calculation was made before Mr. John Whitehead's great discoveries in the highlands of North Luzon (see *Ann. N. H.*, ser. 6, vol. xvi., p. 160, and *Trans. Zool. Soc.*, vol. xiv., pt. 6) were announced by Mr. Thomas. These embrace five new generic forms of rodents, and there are probably more to follow.

which is found in the Malay Peninsula, Sumatra, and Borneo, the only other Tapirs now existing in the world being met with in Central and Southern America. This is one of the most interesting cases known of what is termed "discontinuous" distribution, but the explanation of it is not very difficult. If we turn to the records of palæontology, we find undoubted remains of the members of the genus *Tapirus* recorded in the Miocene formation of France, in North America, and also in the Pliocene of China. There can be little doubt, therefore, that the Tapir, which is a harmless beast, destitute of all means of offence and defence, has been driven out of these northern countries into the tropical forests of South America and Malaya, where the absence of competition has enabled it to survive.

Among the Malayan Rodents we find the squirrels (*Sciuridæ*) even more abundant than in the last Subregion. Two of the species belong to a separate genus (*Rhithrosciurus*) which does not occur elsewhere. There are also two endemic genera of rats (*Muridæ*) — one (*Phlæomys*) from the Philippines, the other (*Pithechirus*) from Sumatra and Java.

A genus of Porcupines (*Trichys*), which differs from *Atherura* in several important cranial characters, is confined to Borneo.

Three genera of Malayan Carnivores are worthy of special mention. One of these is *Hemigale*, not very far removed from the Palm-cats, with two species, a second one having been recently discovered by Mr. Hose in the mountains of Borneo. The second is *Cynogale*, also belonging to the same family. The latter, which is semi-aquatic in its habits, and bears a superficial resemblance

to an otter, is found in the Malay Peninsula, Borneo, and Sumatra. A third endemic Carnivore, *Mydaus*, which,

FIG. 28.—THE ORANG.
(*Simia satyrus.*)

like the American Skunk, is remarkable for the very powerful odour emitted from its anal glands, was originally

described from the mountains of Java, but has since been obtained from Sumatra and Borneo.

Of the Insectivores by far the most important genus in the Malayan Sub-region is the Tree-shrew (*Tupaia*), of which at least a dozen species are here found. The Tree-shrews are small animals, of the general appearance of squirrels, that live chiefly among the branches of trees, and, like the squirrels, sit on their haunches and use their fore limbs for holding their food. An allied genus, with an elegant double fringe of long hair to its tail (*Ptilocercus*), is confined to Sumatra and Borneo.

Tarsius, belonging to a distinct family of Lemurs, inhabits the forests of most of the islands of the Sub-region, as well as Celebes. It is a small animal, about the size of a squirrel, deriving its name from the fact that the tarsal bones of its foot are greatly elongated.

Among the Monkeys, in addition to the three genera found also in the Burmese Sub-region, we have the Proboscis Monkey (*Nasalis*) of Borneo, very remarkable for its large and projecting nasal organ. Finally, in Sumatra and Borneo we find the Orang (*Simia*), of which there are possibly two species, although this is by no means certain. These large man-like apes (see Fig. 28, p. 144), which form, along with the Gibbons, and the African Chimpanzee and Gorilla, the family *Simiidæ*, inhabit mostly the low swampy districts near the coast; they may be distinguished at once from their African cousins by the reddish-brown colour of the long hair with which they are clothed. In some respects they are the most closely allied to Man in structure of the anthropoid Apes.

The following is a summary of the Malayan genera of mammals, constructed on the same plan as in the case of

the other Sub-regions. It will be seen that, while the total number of genera has not increased very much, the number of endemic genera is nearly doubled, as compared with those of the other two Sub-regions.

	Edentata.	Ungulata.	Rodentia.	Carnivora.	Insectivora.	Chiroptera.	Primates.	Total.
Endemic	0	0	4	3	1	1	2	11
Oriental	0	1	1	4	3	3	3	15
Palæarctic	0	2	1	2	1	0	2	8
Ethiopian	1	2	1	2	0	1	0	7
Australian	0	0	0	0	0	2	0	2
Palæogean	0	1	3	1	1	12	0	18
Cosmopolitan	0	3	3	5	0	3	0	14
Total	1	9	13	17	6	22	7	75

Section VII.—The Celebesian Sub-region

As already mentioned, the island of Celebes presents a problem of considerable interest to the student of geographical distribution. Celebes is separated from the other islands, both to the eastward and to the westward, by seas of considerable depth. Compared with the other Malayan islands, its fauna is scanty. This fact, and the very peculiar shape of the island, suggest a possibility of its having been formerly of greater extent, and of having been subsequently reduced by subsidence.

We will first review the mammal-fauna, and then try and deduce, from a study of it, our conclusions as to its past history.

In Celebes alone of the Oriental Region we find repre-

sentatives of the marsupials characteristic of the Australian Region. These consist of two species of *Phalanger*, which differ from those of the Australian islands only in slight particulars.

The next interesting animal of this fauna is the Babirussa, a wild pig remarkable for the enormous size of its upper and lower canine teeth, which form, as it were, two pairs of horns on the upper side of the head. Another peculiar Ungulate, now generally referred to the widespread genus *Bos*, is the Anoa, which shows many primitive characters, and is entirely confined to the island.

The Mice and Squirrels of Celebes are fairly numerous, and most of the species are peculiar to the island; one rat forms a special genus.

Carnivores are very scarce in Celebes; Insectivores have not been recorded at all. The Bats, which are numerous, comprise a considerable number of Australian forms, and one peculiar genus.

Among the Primates, *Tarsius* of the other Malayan islands is also found in this Sub-region, and one Monkey, *Macacus maurus*, seems to be restricted to it. Finally, one of the most remarkable of the animals of the island is the Black Ape of Celebes, belonging to a genus (*Cynopithecus*) intermediate between the Macaques and the Baboons. *Cynopithecus* appears to have found its way from Celebes into the adjoining island of Batchian, which belongs to the Australian Region.

The following table shows the mammals of this Sub-region arranged in a form like those of the other Sub-regions:—

	Marsupialia.	Edentata.	Ungulata.	Rodentia.	Carnivora.	Chiroptera.	Primates.	Total.
Endemic	0	0	1	1	0	1	1	4
Oriental	0	0	0	0	1	2	1	4
Australian	1	0	0	0	0	2	0	3
Palæogean	0	1	1	2	1	9	1	15
Cosmopolitan	0	0	2	1	0	2	0	5
Total . . .	1	1	4	4	2	16	3	31

From this summary it will be seen that the total number of Mammal-genera that occur in Celebes is thirty-one, the greater number of which (twenty in all) are placed under the headings of Palæogean and Cosmopolitan. These are all widespread genera, which do not afford us any particular clue to the origin of the Celebesian fauna. Nine out of the twenty are genera of Bats, which, as has before been remarked, are by nature much less restricted in their range than the true quadrupedal mammals. Of the remaining eleven only two (*Mus* and *Sus*) have any extensive distribution in the Australian Region; the others, although they have, in one or two cases, managed to struggle into adjoining islands belonging to the Australian Region, can in no sense be viewed as Australian genera.

Of the genera registered in the table as "Australian," two are Bats, which have apparently reached Celebes from the more easterly islands of the Australian Region, where they have a wide distribution; the other is the genus *Phalanger*, which has been already alluded to as being the only member of the Marsupial Order found in the Oriental Region.

The endemic genera of Celebes are four in number, and judging from their affinities, it is impossible to believe that they have any relation to the animals now living in the Australian Region. Everything points to their being remains of a very ancient fauna, which must have been originally derived from the Asiatic continent.

The presence of the three Australian genera in Celebes does not in any way require the supposition of an ancient land-connection with that Region. This is obviously so in the case of the Bats, and the Phalanger is a strictly arboreal animal, and might easily have been drifted across a narrow strait on floating timber. On the other hand, to account for the greater proportion of Oriental forms found in the island, we are driven to the conclusion that at some time or other there has been some sort of land-connection between Celebes and the mainland of Asia. These are the principal reasons for transferring the island of Celebes from the Australian to the Oriental Region.[1]

Section VIII.—The Past History of the Oriental Mammal-fauna

Considerable controversy has arisen from time to time with regard to the similarities that undoubtedly exist between the faunas of the Oriental and Ethiopian Regions. Some writers have urged that, in order to account for this, some form of direct land-connection must have existed at one time or another across the Indian Ocean between

[1] For the most recent information on the mammals of Celebes see Meyer, "Säugethiere von Celebes und Philippinen-Archipelago," *Abh. Mus. Dresden*, vi., No. 6.

Southern India and South Africa. Others have maintained that the points of similarity between the two faunas have been exaggerated, and that no such land-connection is required to account for the facts, which can easily be explained on the supposition of a southward emigration of northern forms due to glacial cold.

If we go back to the early part of the secondary epoch of geological time, we find, very well developed in India, a geological system known as the Gondwana, composed of sandstones and shales, which appear to be of fluviatile origin. These beds have long afforded a problem to geologists, as they cannot be at all satisfactorily correlated with any formations in Europe. In South Africa, however, we find a series of beds, also doubtless of fresh-water origin, known as the Karroo formation, which contains a nearly similar set of fossil remains, and in New South Wales, again, there are formations also agreeing in the characters of their fossils with the Gondwana beds. These facts, according to Mr. Oldham (3), our latest authority on this subject, are "inexplicable, unless there has been a continuous land-communication along which plants could freely migrate, and the conclusion is vastly strengthened when we remember that throughout the great part, if not the whole, of this period, a very different type of flora was flourishing in Europe and North America."

This land-connection may be of use in explaining the distribution of some of the lower vertebrates, but is of no assistance so far as the Mammals are concerned; because in those early times it is probable that none of the families or even orders of our present Mammals had arisen. The best-known and richest of the mammal-bearing formations of India are certain beds in Sind, and the

Siwalik deposits lying along the foot of the Himalayas. These beds, especially the latter, contain the remains of an extensive and exceedingly interesting Mammalian fauna, which has hitherto been very inadequately explored, and will probably afford abundant opportunities of discovery to the palæontologist of the future.

The number of genera hitherto discovered in these formations amounts in all to about sixty, of which thirty-nine are still in existence, while twenty-five are extinct. Among the recent genera are a considerable number which, though still occurring in Africa, have become extinct in the Oriental Region; such are *Bubalis*, *Cobus*, *Oreas*, and *Strepsiceros*—all genera of antelopes, *Giraffa* (the Giraffe), *Hippopotamus*, *Loxodon* (the African Elephant), *Cynocephalus* (the African Baboon), and *Anthropopithecus* (the Chimpanzee), while others still survive in India.

The most remarkable feature, however, of the Siwalik fauna is the fact that, while certain of the genera are only found in Miocene beds in Europe, and not in more recent deposits, the greater number are only known, out of India, from the Pliocene and Pleistocene, so that it is very difficult to fix the age of the Siwaliks as compared with the formations of Europe.

Beds containing a somewhat similar fauna, in most cases not so rich, have been discovered in Greece, near Athens, in Samos, and in one or two other localities, at least, in South-Western Europe; while north of the Alps nothing of the sort has been found of a corresponding age. The most plausible explanation of the whole matter, therefore, so far as we can say at present, is that the increasing cold at the end of the Miocene and the beginning of the Pliocene times gradually drove the

northern inhabitants southwards. It thus came to pass that, at that period of the world's history, the Mammalian faunas of Southern Europe, South-Eastern Asia, and of India were so nearly uniform as to constitute these countries, as regards their mammals, one widely extended Region.

LIST OF THE PRINCIPAL AUTHORITIES REFERRED TO IN CHAPTER V.

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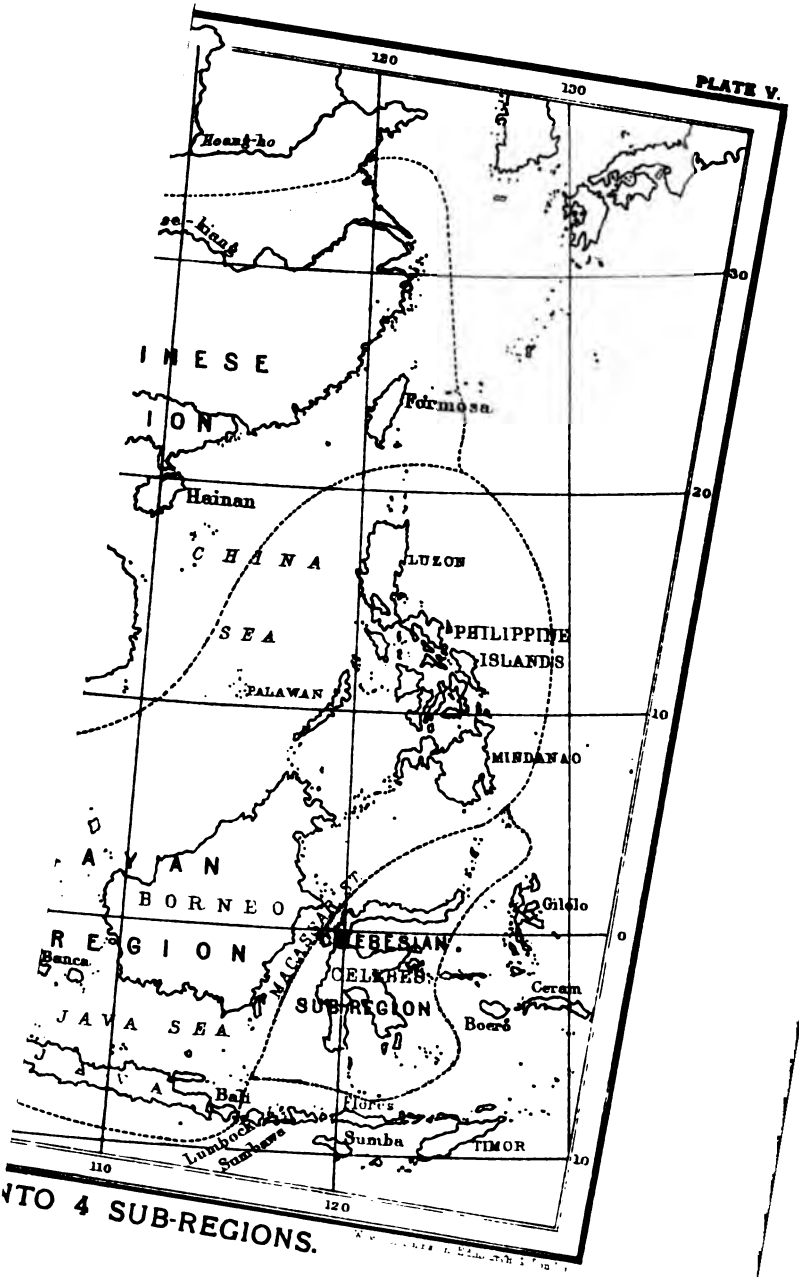
(2) BLANFORD, W. T.—"The Fauna of British India: Mammalia." London, 1888–91.

(3) OLDHAM, R. D.—"Manual of the Geology of India." Calcutta, 1893.



NTO 4 SUB-REGIONS.

CHAPTER VI

THE NEARCTIC REGION

(PLATE VI, p. 176)

SECTION I.—BOUNDARIES OF THE NEARCTIC REGION

WITH the Nearctic Region we enter upon a subject on which there has been a great deal of controversy among the students of geographical distribution. As was pointed out in the introductory article of this volume, a certain number of writers maintain that this Region does not contain a sufficient quantity of distinctive and indigenous forms to entitle it to separation from the Palæarctic Region. What should constitute a sufficient number of distinctive forms depends, of course, largely on the individual opinions of the writers, but if allowance be made for the undoubted similarities of the extreme northern parts of the Old and New Worlds, which together may be considered as forming a kind of intermediate district, the facts and figures given below will, we think, convince every one that the land-surfaces of the Palæarctic and Nearctic Regions have now, and have had in the past, quite sufficiently distinct faunas to warrant their division into two primary Regions.

The boundaries of the Nearctic Region are comparatively simple. They embrace the whole of North America as far as the southern limit of the tableland of Mexico, with which Greenland may be included. On either side of

the tableland of Mexico, the Neotropical Region extends as a narrow strip along the Gulf of Mexico and the Pacific, as far north as the Rio Grande on the former coast, and to about Guaymas on the latter.

There are no islands of any importance belonging to this Region that need be mentioned here. The Pacific islands on the west coast of Mexico have few, if any, mammals. The large islands of Newfoundland and Vancouver are of the true continental type, being separated from the mainland only by quite shallow water. The Antilles, or West India islands, belong entirely to the Neotropical Region, and have been already considered in a previous chapter.

Section II.—General View of the Mammal-fauna of the Nearctic Region

On referring to the table given at the end of the first chapter, it will be seen that the total number of genera, and also of species contained in the Nearctic Region, is considerably less than in any of the other Regions hitherto treated of. This may be explained partly by the fact that the whole of this Region is practically outside the tropics, whereas the other Regions previously described lie to a great extent within the tropical zone, which is very favourable to the development of a rich and varied fauna.

Out of the nine Orders into which the terrestrial Mammals have been divided, two only are not represented in this Region. These are the Primates, at the head of the list, and the Monotremes, at the extreme end, the latter being confined to the Australian Region. The Marsupials

are represented by one species only, the well-known Virginian opossum (Fig. 29), which is found with slight modifications from the Southern States of North America

FIG. 29.—THE VIRGINIAN OPOSSUM.
(*Didelphys virginiana.*)

southwards over the greater part of South America. This animal would, perhaps, judging merely by the present distribution of life, be considered to have intruded into the Nearctic Region from South America, where alone members of this family still survive; but, on examining its past

history, we ascertain that the genus *Didelphys* was formerly found both in Europe and in North America during Eocene and Miocene times, so that it is possible that the Virginian

FIG. 30.—THE PRONG-BUCK.
(*Antilocapra americana.*)

opossum may be a survivor rather than an intruder in North America.

The next order, the Edentates, is represented in this

Region only by a single species of armadillo (*Tatusia novem-cincta*), which almost certainly came up from the south, and is only met with just inside the southern borders.

FIG. 31.—THE ROCKY-MOUNTAIN GOAT.
(*Haploceros montanus.*)

Among the Ungulates, the most remarkable form is the prong-buck (*Antilocapra*), which forms a distinct family of that order, and is entirely confined to this Region (Fig. 30, p. 156). It is allied in some respects to the Antelopes of the

Old World, but it is unique among all the hollow-horned ruminants from the fact that it sheds its horns every year.

Two other genera, belonging to the family Bovidæ, are confined to the Nearctic Region; these are the Rocky Mountain goat (*Haploceros*), found only in the Rocky

FIG. 32.—THE MUSK OX.
(*Ovibos moschatus.*)

Mountains (Fig. 31, p. 157); and the Musk Ox (*Ovibos*), which ranges over the barren grounds at the extreme north of the continent, and spreads into Greenland (see Fig. 32). The latter, however, was also found in the northern parts of the Old World until a comparatively recent epoch, geologically speaking.

The Bisons (Fig. 33) are still common to the Nearctic and Palæarctic Region, though now nearly extinct in both hemispheres.

Rodents are very numerous in the Nearctic Region. According to the tables here used, which have been compiled from Flower and Lydekker's text-book of

FIG. 33.—THE AMERICAN BISON.

(*Bison americanus.*)

mammals, out of a total number of twenty-eight genera, thirteen are endemic. One of these, *Haplodon*, a small animal resembling the Prairie-dog in its habits, and found only west of the Rocky Mountains, forms a distinct family.

The Carnivora are also well represented, especially the genera of Cats, Dogs, Bears, and Weasels, all of which,

however, are widely spread. The only endemic genus is that formed for the reception of the American Badger (*Taxidea*), which differs from its European ally in certain anatomical features.

In contradistinction to the Neotropical Region, the Insectivora are abundant in the Nearctic; there are no less

FIG. 34.—THE STAR-NOSED MOLE.
(*Condylura cristata.*)

than four genera of Moles met with, three of which are peculiar.

Amongst them is the remarkable Star-nosed Mole (*Condylura cristata*) which carries a ring of riband-like appendages at the end of its snout. These serve, no doubt, as a sensitive organ (see Fig. 34).

Finally, the Bats are neither very numerous nor of

great importance; only one genus (*Antrozous*), containing one species, being peculiar out of a total of nine.

Summarizing, therefore, we find the Nearctic Region to be characterized by the exclusive possession of only two families of Mammals—namely, Antilocapridæ (the Prong-bucks) and Haplodontidæ (the Haplodonts), and by the presence of sixty-six genera, of which twenty-one are restricted within its boundaries. On the other hand, in addition to the two orders already mentioned, Monotremes and Primates, the following important families are absent in the Nearctic Region, although fairly well spread over the Old World:—

Suidæ (Swine).	Hyænidæ (Hyenas).
Equidæ (Horses).	Erinaceidæ (Hedgehogs).
Myoxidæ (Dormice).	Pteropodidæ (Fruit-eating Bats).
Viverridæ (Civets).	Rhinolophidæ (Leaf-nosed Bats).

That some of these families did, however, at one time exist on the North American continent has been shown by recent palæontological discoveries.

Section III.—Sub-division of the Nearctic Region

The recent work of American naturalists, more especially that of Merriam (2) and of Allen (1), has greatly increased our knowledge of the mammals of North America and of their distribution. These naturalists have further shown that the Sub-regions adopted by Wallace in his well-known text-book on geographical distribution are not altogether supported by the facts now known to us.

Mr. Allen, in his paper on the distribution of North

American mammals, first of all excludes from what he terms the North American Region the extreme northern parts of that continent. He considers that the Arctic portion of that continent, namely, that beyond the limit of arboreal vegetation, forms, together with the similar part of the Old World, a separate Region, or, as he terms it, "the Arctic Realm."

Furthermore, the southern part of North America south of the Mexican tableland, together with the low-lying country of Mexico on either flank, he assigns to the American Tropical Realm. The remainder of the continent, combined with the great mass of Europe and Asia, forms, according to this author, the North Temperate Realm. This scheme of division does not differ essentially from that of Mr. Allen. The Arctic portion of North America forms, no doubt, as Mr. Allen puts it, "part of a homogeneous hyperborean faunal area of circumpolar distribution."

Mr. Allen's American Tropical Realm has already been treated of in the chapter of this volume dealing with the Neotropical Region (see p. 52). There remains, therefore, Mr. Allen's North American Region, which nearly corresponds to the Nearctic Region of our scheme of classification. Mr. Allen divides his North American Region into two Sub-regions—the Cold Temperate and the Warm Temperate, the two latter falling into two provinces, a Humid or Eastern and an Arid or Western. Proceeding further, he divides the Humid province into two sub-provinces, namely, an Apalachian or Northern and an Austro-riparian or Southern. The Arid or Western province is also separated into two sub-provinces—the Campestrian or Northern and the Sonoran or Southern, and, besides this, the sub-

provinces are divided into various minor divisions termed districts and faunas.

It will be sufficient for our present purpose to divide the North American or Nearctic Region into three Sub-regions; these may be termed, (1) the Canadian or Cold Sub-region, (2) the Western or ~~Humid~~ Arid Sub-region, and (3) the Eastern or ~~Arid~~ Humid Sub-region.

Mr. Wallace has recognized four Sub-regions in the Nearctic Region. His Canadian Sub-region corresponds fairly well to the Canadian or North Temperate of Mr. Allen, except for the fact that it has not been made by Mr. Wallace to extend southward down the mountain ranges. The Alleghany Sub-region of Mr. Wallace, again, practically corresponds to the "Humid" of Mr. Allen. The two others, the Rocky Mountain and Californian, correspond to Mr. Allen's "Arid," the Californian Sub-region being composed of a narrow strip of coast country between the Sierra Nevada and the sea, and extending from Queen Charlotte's Sound in the north to the south-western corner of California. The differences, therefore, between Mr. Wallace's and Mr. Allen's views are not so fundamental as one would gather from the critical remarks of the latter author.

The boundaries of the Sub-regions here adopted will be best understood by reference to the accompanying map (Plate VI., p. 176).

The Canadian or Cold Sub-region embraces the whole of the northern portion of North America, including Greenland. The southern limit of this Sub-region commences, on the Atlantic side, on the coast of Maine, in the neighbourhood of Augusta, and thence runs to Quebec and through the Great Lakes. Further west it is bounded

by the northern branch of the Saskatchewan, and ends on the Pacific coast in the neighbourhood of Queen Charlotte's Sound. But long prolongations of this Sub-region extend down the Alleghany mountains; in the east as far as Georgia, along the Rocky Mountains as far as the Rio Grande, and along the Cascade and Sierra Nevada mountains as far as the Colorado river. Besides these, there are several smaller detached portions of other mountain ranges, which should be attributed to the Canadian Sub-region.

The Eastern or "Humid" Sub-region is separated from the Western or "Arid" by a line running roughly nearly along the meridian of 100° west of Greenwich, and extending from Manitoba to the mouth of the Rio Grande del Norte.

Section IV.—The Canadian or Cold Sub-region

The Canadian Sub-region is especially remarkable for a number of genera which are common to it and the northern part of the Old World, but which do not extend southwards into the other Sub-regions to be presently treated of. It is further characterized by the small number of genera which are essentially New World forms, and have no connection with the Old World. Reviewing the Mammals in detail, we find that the Sub-region contains no representative of either Marsupials or Edentates. On the other hand, there are six genera of the Ungulates within its limits—a far larger proportion than that found in the other Sub-regions. Of these the only one endemic is *Haploceros* (the Rocky Mountain goat). This somewhat isolated Ruminant has its nearest allies in the genus

Nemorhædus, of the mountains of Asia, which occurs in Japan (*N. crispus*), but of which the best-known form is commonly designated the "Serow" by the sportsmen of the Himalayas. There are also no less than four genera found in the Old World, and also in the Canadian Sub-region, which do not extend further south. These are *Cervus*, containing the Wapiti (*C. canadensis*), closely allied to the Red Deer of the Old World; the Cariboo (*Rangifer*), which cannot be distinguished from the Reindeer of the northern part of the Palæarctic Region: and the Moose (*Alces machlis*), which has the same distribution as the Reindeer, but is known in Europe under the name of "Elk." Besides these, there are two Canadian genera of this order which are found in other Sub-regions as well as in the Old World, namely, the Bison (*Bison*) and the Sheep (*Ovis*). The Bison, of which the American representative is the so-called buffalo (now, alas! nearly extinct), is closely allied to the European Bison, still found in certain parts of the Old World; while the Big-horn Sheep (*Ovis canadensis*) is a representative of the Wild Sheep, which are extensively distributed in the Palæarctic Region. The number of genera of Rodents of the Canadian Sub-region amounts in all to eighteen, of which three are peculiar. One of these is *Haplodon*, to which allusion has already been made; the others are *Phenacomys*, a small genus of rats, and *Erethizon*, which contains only the Tree-porcupine of the Canadian forests. Among the members of this order, too, we find three genera common to this Sub-region and the Old World, which do not extend further south. These are *Myodes* (*M. obesus*), which is represented in Europe by an allied species, the well-known Lemming of Scandinavia; *Cuniculus*, a form nearly allied to the Lemming; and

Lagomys, the "Pika," or Tailless Hare, which is found in the higher mountain ranges of both the Old and the New Worlds.

The Carnivora do not present many features of special interest. Two genera—*Mustela*, containing the Weasels, and *Gulo*, the Glutton, have much the same circumpolar distribution as has been already remarked on in the case of the Deer and the Lemming.

The number of genera of Insectivora and Chiroptera in the Canadian Sub-region is insignificant, and they are of no interest from a distributional point of view.

Viewing the fauna of the Canadian Sub-region as a whole, it will thus be seen that its greatest point of interest is its resemblance to that of the more northerly parts of the Old World. This, of course, may be easily accounted for when we recollect that the sea of Behring Straits is quite shallow, and in places not more than about 20 miles in breadth. There can be no doubt that there was a land-connection between Siberia and Alaska in comparatively recent geological times, and that this has resulted in the commingling of the faunas of the northern parts of these two Regions, to a considerable extent. This land-bridge must have existed so recently that there has not yet been even time for, in some cases, the animals to become differentiated into appreciable species, as in the cases, for example, of the reindeer and elk.

Below will be found a summary of the genera of the Canadian Sub-region, forty in number, which are divided into five categories much in the same fashion as has been done in the previous articles, namely:—

1. *Endemic*—those found only in the Canadian Sub-region.

2. *Nearctic*—those not found beyond the limits of the Nearctic Region.

3. *Neogean*—those found in the New, but not in the Old World.

4. *Arctic* and *Palæogean*—those which are found in the Old World, and only in the Canadian Sub-region of the New; and, finally—

5. *Neogean* and *Palæogean* — containing the most widely distributed forms.

	Ungulata.	Rodentia.	Carnivora.	Insectivora.	Chiroptera.	Total.
1. Endemic	1	3	0	0	0	4
2. Nearctic	0	3	1	1	0	5
3. Neogean	0	0	2	0	1	3
4. Arctic and Palæogean	4	3	2	0	0	9
5. Neogean and Palæogean	1	9	6	1	2	19
Total . .	6	18	11	2	3	40

SECTION V.—THE WESTERN OR ARID SUB-REGION

This Sub-region is, on the whole, the richest of the three, both as regards the total number of genera found within its limits and also as regards the number of genera peculiar to it, which amounts to seven out of fifty-three, as compared with four out of forty in the Canadian, and one out of forty in the Eastern.

The Western Sub-region shares with the Eastern the only representative of the Marsupials found in North America, the Virginian Opossum. Just extending, too, to within its limits occurs the only member of the Order

Edentata, the Nine-banded Armadillo (*Tatusia novemcincta*). Among the Ungulates, the Prong-buck (*Antilocapra*) is restricted to this Sub-region, and the genus *Cervus* of the cold Temperate Sub-region is replaced by the purely American genus *Cariacus*, of which the Black-tailed Deer is the representative.

This Sub-region is also more particularly the home of the American Bison, which, however, ranged even in historic times eastward nearly to the Atlantic seaboard. Among the Rodents there are no less than five endemic genera, of which, perhaps, the best known is *Cynomys*, the Prairie-dog. The other endemic genera all belong to the family *Geomyidæ*, which contains a number of small Rodents known as Pocket-gophers.

Among the Carnivora there are no genera in the Western Sub-region which are not more or less widely distributed, the greater number of them, both in the case of this order and of the last, being also found in the Old World. Three genera of Moles belonging to the next order, Insectivora, though confined to North America, extend into the Eastern Sub-region. The Bats of the Arid Sub-region include among their members two genera (each with one species) which occur only in California, while four other genera are found only in the New World. One of these, *Macrotus*, is of special interest, since it contains the only member of a very large and well-marked family (*Phyllostomatidæ*), which extends into the Nearctic Region from South America.

This Sub-region, as compared with the Canadian, contains a far larger proportion of Neotropical genera, and, in addition, is characterized by the absence of a number of the Palæarctic forms found only in the Canadian Sub-region.

Such, for instance, are *Rangifer* (the Reindeer), *Alces* (the Elk), *Haploceros* (the mountain goat), *Gulo* (the glutton), and many others.

The following table, which gives a summary of the genera of this Sub-region, differs only from the summary of the Canadian Sub-region in the omission of the heading "Arctic and Palæarctic," since practically all the genera common to this Sub-region and the Palæarctic Region are also found in the Canadian Sub-region.

	Marsupialia.	Edentata.	Ungulata.	Rodentia.	Carnivora.	Insectivora.	Chiroptera.	Total.
Endemic	0	0	1	4	0	0	2	7
Nearctic	0	0	0	5	1	3	0	9
Neogean	1	1	2	3	5	0	4	16
Neogean and Palæogean. .	0	0	1	9	6	2	3	21
Total . . .	1	1	4	21	12	5	9	53

Section VI.—The Eastern or Humid Sub-region

So far as peculiar forms go, the Eastern Sub-region is quite the least peculiar of the three. It contains only one genus strictly confined within its limits; this is *Neofiber*, with a single species commonly known as the "Round-tailed Musk-rat." This Rodent is found only in Florida, and is much less completely aquatic in its habits than the true Musk-rat (*Fiber*), which is spread over the rest of North America.

Taking the orders *seriatim*, the Marsupials are represented by the widely spread Virginian Opossum; but the Edentates do not reach the Region at all. Of the Ungulates

only the genus *Cariacus* (the Virginian Deer) occurs, the Bison (though formerly inhabiting this Sub-region) not having been seen east of the Mississippi for the last forty or fifty years.

The Rodents, as in the other Sub-regions, make up the great mass of the mammalian genera, numbering seventeen in all, including *Neofiber*.

The Carnivores, Insectivores, and Bats do not differ very markedly from those of the Western Sub-region.

On the whole the Eastern Sub-region is not a very well-marked division; it differs from the Canadian chiefly in the non-existence of the numerous northern Palæogean types found there, and from the Western Sub-region in the absence of a good many characteristic desert-haunting forms, and also of several of the South American genera, which have spread up northwards from the Nearctic Region into the Western Sub-region, but which have not reached the more distant Eastern.

The following table gives a summary of the genera of this Sub-region, from which it will be seen that the total number (forty) of genera is markedly less than the corresponding number in the Arid Sub-region.

	Marsupialia.	Ungulata.	Rodentia.	Carnivora.	Insectivora.	Chiroptera.	Total.
Endemic	0	0	1	0	0	0	1
Nearctic	0	0	5	1	3	0	9
Neogean	1	2	2	3	1	2	11
Neogean and Palæogean . . .	0	0	9	5	1	4	19
Total . .	1	2	17	9	5	6	40

Section VII.—The Past History of the Nearctic Mammal-fauna

During the last twenty years the wonderful discoveries of American palæontologists have thrown a flood of light, not only on the past history of the Nearctic Region, but also on the evolution of many of the mammalian groups themselves. It is, therefore, very necessary, when reviewing the geographical distribution of the present mammalian fauna, to shortly recapitulate the more important results and conclusions arrived at from their writings.

A very useful and comprehensive summary of this work will be found in a paper by Professor Zittel (3), lately published in the *Geological Magazine*. The beds which contain the remarkably perfect remains above alluded to are found only in the western part of North America. Here, apparently, there existed throughout the Tertiary Epoch a series of great fresh-water lakes, on the sides and the bottoms of which were formed an almost continuous series of deposits with the remains of the animals of the surrounding districts embedded in them. The great interest of these discoveries lies in the fact that we can here trace the gradual formation and evolution of several of the mammalian orders as they at present exist. In the oldest beds the mammals resemble one another so closely that it is often impossible to assign them very definitely to any of the existing orders, although the germs of the commencing distinctive characters can even here be traced.

In the later beds the various groups gradually differentiate themselves, until in the most modern of

the deposits the genera can all be definitely assigned to existing orders.

The earliest mammals that have been found in North America come from the Trias of North Carolina, but neither these nor any of the other mammalian remains of the Secondary Period tend to assist the geographical problems involved, or are of importance in the present juncture.

With the oldest Tertiary beds an entirely new fauna appears, and furnishes us with remains of forms belonging to various orders of which no traces can be found in the earlier Secondary deposits. The following is a short list of these deposits, together with their European equivalents, so far as they can be ascertained:—

Lower Eocene .	Puerco beds of New Mexico. Wasatch beds of Wyoming, Utah, and New Mexico.
Mid-Eocene . .	Bridger beds of Wyoming.
Upper Eocene. .	Uintah beds of Utah and Wyoming.
Lower Miocene .	White-river beds of Nebraska, Dakota, Colorado, and Wyoming.
Mid-Miocene . .	John-Day beds of Oregon, Nevada, and Washington.
Pliocene . . .	Loup-Fork beds of Nebraska, Colorado, Wyoming, Kansas, and New Mexico.
Late Pliocene .	Equus beds of Western and South-Western States, and Megalonyx beds of Eastern States.

In the lowest Eocene beds, not only the Genera, but even the Orders of mammals are in almost every case different from those at present existing. The greater number of these belong to two orders—Creodontia and Condylarthra; the former the progenitors of the modern Carnivora, the latter of the existing Ungulata. These

two, and indeed the other orders to which the mammals of this fauna have been assigned, all show considerable points of resemblance to one another, first in the possession of five toes on both limbs, which are provided with neither claws nor hoofs, but with a structure somewhat intermediate between the two, and, secondly, in their extremely small cerebral cavity. A similar, though much more incomplete Fauna has been found in certain beds of a corresponding age in Europe, the Genera of their fossil mammals being in most cases identical with those of the Nearctic Region.

In the next stage, the Wasatch beds, which correspond in age nearly to the London clay of England, a further development of the same fauna is found, with, however, the commencement of certain of the modern Orders; such, for instance, as the *Perissodactyla* (or Odd-toed Ungulates), the Rodents, the Insectivores, and the Lemurs. Here, too, so far as the scanty remains found in Europe allow us to form a comparison, there is a close similarity between the faunas of the two Regions.

In the succeeding "Bridger beds" of Mid-Eocene age is found the earliest evidence of the still surviving genus *Didelphys* (the Opossum). Here also marine Mammals and Bats appear for the first time. But comparison of these remains with European forms is even more difficult than in the last case, owing to the scarcity of such fossils in beds of the same age in Europe.

In the Uintah beds of the Upper Eocene we first begin to find very distinct traces of differentiation between the European and the North American faunas, although a good many of the Genera met with are still common to the two Regions.

A great advance is found in the Fauna of the White-river beds of Miocene age. In this case the mammals can almost be referred to existing orders, but comparatively few of the genera are common to the Old and New Worlds; and it appears that, whilst during the older Eocene there was a considerable emigration of New World forms into Europe, in Miocene times the stream was reversed, and North America received the greater number of its immigrants from this side of the Atlantic. This immigration continued during the Middle Miocene epoch, the Fauna of which has been well preserved in the John-Day beds of the extreme west. At the same time many endemic Families and forms are also met with, especially as regards the early predecessors of the Camel Family, which apparently had its origin and early development in the Nearctic Region, though now entirely absent from it. In the John-Day beds, we also find, for the first time, remains of the modern genera, *Rhinoceros*, *Sciurus*, *Hesperomys*, and *Lepus*.

The succeeding "Loup-Fork beds" contain additional recent genera, some of which, such as *Equus* and *Camelus*, are now no longer found in the Nearctic Region, while others, such as *Canis*, *Mustela*, and *Lutra*, still remain there. On the whole, however, the Fauna of this epoch is still further removed from that of the corresponding period of the Old World than that of the preceding.

A little later, in the so-called "Equus-beds" of the Western States, and in the contemporaneous "Megalonyx-beds" of the Eastern, we first find a number of Neotropical forms, such as *Mylodon* (a gigantic Sloth), *Glyptodon* (a gigantic Armadillo), *Hydrochœrus* (the Capybara), and

Toxodon, a member of a peculiar extinct family of Ungulates.

The occurrence of all these animals indubitably proves that now for the first time a connection had been formed between the continents of North and South America. Before this epoch, no trace of a Neotropical admixture can be anywhere detected in the Nearctic mammal-fauna.

Thus the evidence of palæontology in every way supports the deductions drawn from a study of the distribution of recent forms, namely, that the bulk of the present Nearctic fauna has been mainly derived from the Old World, although at times the Region has been sufficiently isolated and sufficiently extensive for the independent evolution of its own characteristic forms. In accordance with these deductions, the present remaining inhabitants of the Nearctic Region may be divided into three categories, as follows: (1) The Endemic Fauna, the bulk of which has had, at some considerably remote geological period, a common origin with that of the Palæarctic Region, although it has enjoyed ample time to develop and differentiate itself on its own lines. (2) A Neotropical constituent, which first appeared in the Nearctic Region in Pliocene times. (3) A comparatively modern Palæarctic fragment, in which not only the genera, but frequently the species, are identical in both Regions. This portion of the fauna has probably reached the Nearctic Region by the passage which must have existed in comparatively modern times across Behring Straits. Consequently, while the Neotropical element is the stronger in the south, this last, the Palæarctic element, is far more prevalent in the extreme north.

List of the Principal Authorities referred to in Chapter VI.

(1) Allen, J. A.—"The Geographical Distribution of North American Mammals." *Bull. Amer. Mus. Nat. Hist.*, iv., p. 199. 1892.

(2) Merriam, C. H.—"The Geographical Distribution of Life in North America, with Special Reference to the Mammalia." *Proc. Biol. Soc. Washington*, vii., p. 1. 1892.

(3) Zittel, Karl von.—"The Geographical Development, Descent, and Distribution of the Mammalia." *Geol. Mag.*, 3rd ser., x., p. 401. 1893. (Translated from the *S. B. k. Bayer. Akad. Wiss.*, xxiii., p. 137. 1893).

CHAPTER VII

THE PALÆARCTIC REGION

(PLATE VII., p. 196)

SECTION I.—BOUNDARIES OF THE PALÆARCTIC REGION

THIS, the last of the six great Regions, consists, as its name implies, of the whole northern part of the Old World. Its boundaries have already been defined in previous articles dealing with the Ethiopian and Oriental Regions, these being the only Regions with which it marches. Speaking generally, it may be said to consist of the whole of Europe, the northern border of Africa, and Asia north of the Himalayas. Its southern boundary in Africa was taken, in the article on Ethiopia, as the Tropic of Cancer, but this, of course, is a purely arbitrary line, and runs through the centre of the Sahara Desert. It would, perhaps, be more accurate to put in its place the northern edge of the Sahara as the limit, and to include all the desert country both of Africa and Arabia in the Ethiopian Region.

The question of Egypt is a difficult one, as its fauna undoubtedly contains a mixture of forms characteristic of both the Palæarctic and Ethiopian Regions; on the whole, however, Egypt, up to the First Cataract, is best included in the Palæarctic Region.

In regard to the boundary line between the Palæarctic and Oriental Regions, there can be no doubt that at the higher elevations of the Himalayas a true Palæarctic fauna

is met with. Eastward of Sikkim, however, as has already been shown, it is very difficult to draw a definite line, chiefly in consequence of our defective knowledge; but the boundary already adopted in the case of the Oriental Region seems, on the whole, to be a suitable one—namely, that of the northern water-parting of the Yang-tse-Kiang —thus leaving Moupin, and the district of Eastern Tibet explored by the French missionary, Père David, within the confines of the Palæarctic Region.

There are only two important groups of islands connected with this Region; these are the British Islands in the West, and the Japanese Islands in the East. The faunas of both these insular groups are of the true "continental-island" type, and differ very slightly from that of the neighbouring mainland. This is more especially the case with the British Isles, where we find among the Mammals no peculiarities worthy of mention, with the exception, perhaps, of a recently discriminated stoat (*Mustela hibernica*), said to occur only in Ireland.

Section II.—General View of the Mammal-fauna of the Palæarctic Region

The Palæarctic Region, although covering a larger area than any of the other Regions, comes out only fourth as regards the number, both of species and of genera, of mammals represented in it, being surpassed in this respect by the Neotropical, Ethiopian, and Oriental Regions. The total number of such genera is one hundred and three, out of which twenty-five are absolutely confined within its limits, while four others are highly characteristic of it, though they just pass over its frontiers. The remainder, seventy-four

in number, are mostly widely spread. When these figures have been reduced to percentages, it will be found that only 24 per cent. of the genera are endemic, which is considerably less than in any other of the Regions hitherto treated of.

Reviewing the Fauna in detail, we find that of the nine

FIG. 35.—THE BACTRIAN CAMEL.
(*Camelus bactrianus.*)

terrestrial Orders, six only are represented in the Palæarctic Region, the Edentates, Marsupials, and Monotremes being completely absent. Among the Ungulates, of which a considerable number of forms are found within the Palæarctic sphere, there is a fair percentage of peculiarities. The Bactrian, or Two-humped camel (Fig. 35), is known to

exist still in a wild state only in certain districts of Central Asia, while the Arabian, or One-humped camel, has never yet been met with in a truly wild condition, so that the genus *Camelus* may be considered as truly Palæarctic.

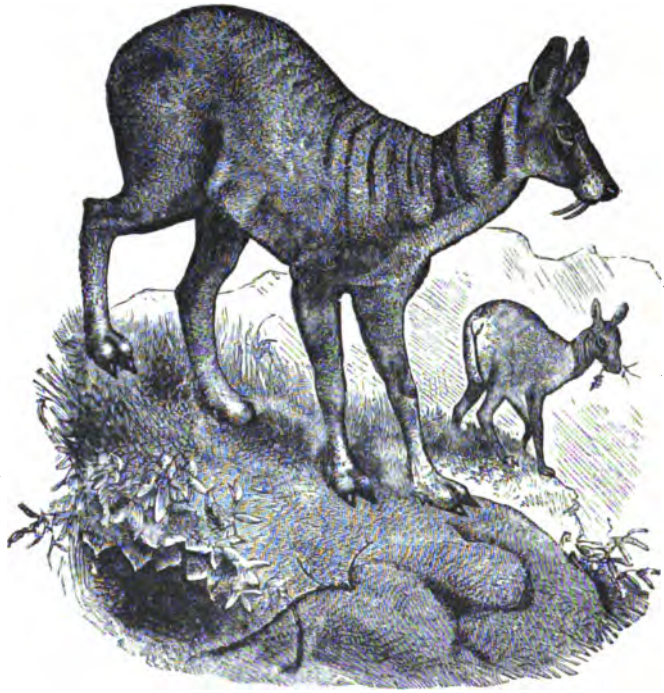


FIG. 36.—THE MUSK-DEER.

(*Moschus moschiferus.*)

[List of Vert. An. 1896, p. 171.]

Two other endemic genera belonging to the Deer-family (*Cervidæ*) are *Moschus*, the Musk-deer, a small hornless deer found only in the higher mountain ranges of Central Asia (Fig. 36); and *Capreolus*, the Roe-deer, fairly well spread over the whole extent of the Region.

Among the *Bovidæ*, *Saiga*, an Antelope found on the steppes of Russia and Western Asia, *Pantholops*, another

FIG. 37.—THE CHAMOIS.
(*Rupicapra tragus.*)

Antelope of the Central-Asiatic mountains, and *Rupicapra*, the Chamois of the European mountain ranges (Fig. 37) are confined to this Region. The important genera of

Sheep (*Ovis*) and Goat (*Capra*) must be considered as especially characteristic of this Region, although stragglers of these forms are found in the confines of the Nearctic and Oriental Regions. They are all mountain animals, one of the best marked forms being the Barbary Sheep

FIG. 38.—THE BARBARY SHEEP.
(*Ovis tragelaphus.*)

(*Ovis tragelaphus*) of Northern Africa (Fig. 38). Of the Rodents, the two most characteristic Palæarctic families are the Dormice (*Myoxidæ*) and the Jerboas (*Dipodidæ*). Of the former family two genera, and of the latter four, are all confined to this Region. There are also two very

peculiar genera of Carnivores met with in this Region. One of these (*Æluropus*) is a curious bear-like creature of a white colour, with the ears, shoulders, limbs, and rings round the eyes black, which has only hitherto been obtained in the high mountains of Eastern Tibet (see

FIG. 39.—THE ÆLUROPUS.
(*Æluropus melanoleucus.*)

Fig. 39). The other genus, *Ælurus*, sometimes called the Panda, is also found in the same district, but extends southwards into Yunnan. Remains of a closely allied species of this genus have lately been found in the Pliocene deposits of England. This animal is usually

placed in the otherwise strictly New World family *Procyonidæ*, which embraces the Raccoons and their allies. The only other carnivorous genus not represented beyond the limits of the Palæarctic Region is *Meles*, containing the familiar European Badger and other species.

FIG. 40.—THE WATER-SHREW.
(*Crossopus fodiens.*)

The Insectivora are found in considerable numbers in this Region, three genera of Shrews and three of Moles being restricted to it. Among these are the little Water-shrew (*Crossopus*) found in England, and thence throughout the Palæarctic Region as far as the Altai mountains. *Crossopus* (Fig. 40) is distinguished by having fringes of

stiff hairs along the sides of its feet and tail, which are doubtless of great assistance to it in swimming. Another shrew, *Nectogale*, found only in Tibet, is still better provided for an aquatic existence, as it has webs between the toes of both fore and hind limbs. The most remarkable endemic representative of the family of Moles in the Palæarctic Region is the Desman, *Myogale*, of which there are two species, one found in the Pyrenees, and the other in the streams and lakes of South-Eastern Russia. The external appearance of these animals, however, resembles much more that of a Shrew than that of a Mole.

Considering that the whole of this Region lies within the temperate zone, the number of its Bats is considerable, although they mostly belong to widespread genera. The Monkeys are represented in the Palæarctic Region by outlying species of two genera, *Macacus* and *Semnopithecus*, which are both abundant in the Oriental Region. To the former of these belongs the well-known Barbary ape (*Macacus inuus*), which inhabits the Rock of Gibraltar and the Barbary States of Northern Africa, as well as several species of Eastern Asia. Another Macaque (*M. tcheliensis*) is enabled by its thickened fur to endure the extremely severe climate of the mountains north of Pekin, and is probably the most northern monkey now living.

Section III.—Sub-division of the Palæarctic Region

The sub-divisions of the Palæarctic Region recognized by Wallace are four in number; these are—First, the *European Sub-region*, which includes Europe north of the

Alps and the continuing mountain ranges that form the backbone of the continent; secondly, the *Mediterranean Sub-region*, which consists of the remainder of Europe, Northern Africa, and Western Asia as far as the borders of the Oriental Region; thirdly, the *Siberian Sub-region*, which includes not only the country from which it takes its name, but also the whole of the desert region of Central Asia, and reaches as far south as the Himalayas; fourth and last, the *Manchurian Sub-region*, containing the greater part of China proper and Manchuria together with Japan.

These Sub-regions, however, do not appear to represent the true faunal divisions of the Palæarctic Sub-region quite adequately. In the first place, there seems to be a fairly continuous and unchanging fauna extending from the west of Europe all across Siberia and embracing the northern island (at any rate) of Japan. This wide area is still, to a great extent, covered with forest, and was, no doubt, mainly so beset until within comparatively recent times.

Again, Wallace's arrangement divides between two Sub-regions the vast extent of desert country that reaches from the Sahara through Egypt, Arabia, Persia, and Turkestan to Mongolia, which also appears to contain a fairly homogeneous fauna. Wallace's Manchurian Sub-region, on the other hand, seems to be well established, and to be the most distinctive of all his Sub-regions, but as it only embraces a part of Manchuria, we prefer to call it the Chinese Sub-region.

We may, therefore, distinguish three Sub-regions in the Palæarctic Region as follows:—

1. The *Europasian Sub-region*, containing Europe, the

whole of Siberia north of the great mountain ranges together with the island of Saghalien, and perhaps, too, the Japanese island of Yezo. In this Sub-region must also be included Asia Minor, the Caucasus, and the Elburz mountains.

2. The *Eremian Sub-region*, including the north of Africa, Northern Arabia, the greater part of Persia and Afghanistan, and the great desert of Central Asia, extending from the steppes of Southern Russia as far as Manchuria.

3. The *Chinese Sub-region*, embracing the greater part of China proper, Southern Manchuria, and Japan, and extending westward to Western Tibet and the top of the southern slopes of the Himalayas.

The boundaries of these Sub-regions will be best understood by referring to the accompanying map (Plate VII., p. 196), in which they are approximately delineated; but it must be always understood that it is in most cases quite impossible to draw a hard and fast line as the boundary between two adjacent Regions on land.

Section IV.—The Europasian Sub-region

The *Europasian Sub-region* contains the great temperate forest-area of the Northern Hemisphere. In its western part, at any rate, this has been considerably modified by the hand of man, but in primæval times the forests probably extended almost without break from the Bay of Biscay to Kamtchatka.

The Europasian fauna is not very rich; it comprises fifty-seven genera of Mammals, of which four only are

restricted to its boundaries. The endemic forms among the Ungulata are *Capreolus*, containing the Roe-deer, a single species of which is found throughout the whole extent of the Region; and *Rupicapra*, the Chamois, found only in the Pyrenees, Alps, Carpathians, and Caucasus. The single endemic rodent is the familiar Dormouse (*Muscardinus*), which is apparently confined to Europe. On the other hand, the little Water-shrew (*Crossopus*) extends from England to the Altai mountains.

There is a considerable number of genera common to the Europasian Sub-region and the Nearctic Region. With the exception, however, of two, the Elk and the Reindeer, these have mostly spread also into the other Palæarctic Sub-regions. On the whole the fauna of this Sub-region has little individuality, and calls for very few remarks as to its distinctness.

Appended is a list of the genera, drawn up in the same manner as in the previous tables.

EUROPASIAN SUB-REGION

	Ungulata.	Rodentia.	Carnivora.	Insectivora.	Chiroptera.	Primates.	Total.
Endemic	2	1	0	1	0	0	4
Palæarctic	2	3	1	1	0	0	7
Old World	3	4	3	3	3	1	17
Holarctic	2	6	2	1	1	0	12
Widespread	3	5	6	0	3	0	17
Total	12	19	12	6	7	1	57

SECTION V.—THE EREMIAN SUB-REGION

The Eremian or Desert Sub-region of the Palæarctic Region contains representatives of a larger number of genera than the Europasian, and a higher percentage of endemic forms, although even here we do not find so much individual character as in some of the Sub-regions previously treated of. A considerable number of the genera are common to this and the Ethiopian Region, which is, perhaps, not to be wondered at, considering the long land boundary which runs between them.

Among the Ungulates only one genus is confined to this Region—the Camel (*Camelus*), which is now found wild only in certain desert tracts of Central Asia, being elsewhere known only in a domesticated condition. But remains of animals of this genus have been found in comparatively recent beds both in India and Algeria. Except for this, other indications seem to point to the fact that the Camels must have had their origin in the New World, where they are now represented only by the Lamas. But remains of several allied genera of *Camelidæ* have been met with in the Tertiary beds of North America, where, however, they have been long extinct. *Bubalis*, which contains the Antelopes usually known as "Hartebeests," and *Hyrax* (the Tree-conies) are common to this Sub-region and the Ethiopian Region. Among the Rodents no less than five genera are confined to the Sub-region, the most remarkable of these being, perhaps, the Jerboas, or Kangaroo-rats, as they are called, from having their hind legs elongated for jumping purposes. The four known genera of Jerboas, which contain a large number of species, are not found

outside the limits of this Sub-region. A fifth endemic genus of rodents is *Ellobius*, which is thoroughly adapted to a subterranean life, having very short limbs and tail, and rudimentary external ears. The only two known species of this genus are restricted to the Eremian Sub-region.

The Eremian Carnivora, as is usually the case with this group, are mostly widespread, and this is also the case with the Bats. The Insectivora are not very numerous, but one genus is peculiar to the Sub-region; this is *Diplomesodon*, a little shrew-like animal of terrestrial habits found in the Kirghiz steppes. Another genus, *Macroscelides* (the Elephant-shrew), though typically Ethiopian, has one species that extends into this Sub-region in Algeria and Tunis.

The Monkeys are represented in the Eremian Sub-region by one species only, the well-known Barbary Ape, (*Macacus inuus*), which is found in Algeria and Morocco.

The genera that occur in the Eremian Sub-region are shown in the following table, which may be compared with the corresponding table appended to the Europasian Sub-region:—

EREMIAN SUB-REGION

	Ungulata.	Rodentia.	Carnivora.	Insectivora.	Chiroptera.	Primates.	Total.
Endemic	1	5	0	1	0	0	7
Palæarctic	2	3	1	1	0	0	7
Palæarctic and Ethiopian	2	3	4	1	2	0	12
Old World	4	5	2	3	7	0	21
Holarctic	0	3	0	0	1	0	4
Widespread	2	4	4	0	3	1	14
Total	11	23	11	6	13	1	65

Section VI.—The Chinese Sub-region

The Chinese Sub-region bears the same relation to the Oriental Region as the Desert Sub-region does to the Ethiopian Region, and the number of genera of Mammals that are common to it and the Oriental Region is considerable.

On the whole, too, this is the most specialized of all the Palæarctic Sub-regions; six genera out of a total number of sixty being endemic, and several others only just crossing its borders. This Sub-region contains within its limits the highest tableland on the face of the globe, that of Tibet, the zoology of which is not so well known as it should be, owing to the persistent exclusion of European travellers from its limits. What knowledge we have of the Tibetan fauna relates chiefly to the larger animals, and among these are several very interesting and peculiar forms. It is, therefore, probable that when more about this Region is known, many novelties will be discovered among the smaller animals as well.

The Ungulates of the Chinese Sub-region show no genera which are absolutely confined to it, but a curious little deer with short straight antlers (*Elaphodus*) is highly characteristic of it, although it extends into the outskirts of the Oriental Region. Another peculiar genus is the Tibetan antelope (*Pantholops*), well known to Indian sportsmen, which is found only at great heights on the Tibetan plateau. A third genus, also of great interest, is the Takin (*Budorcas*), a large bovine animal with horns somewhat resembling those of the

South African Gnu; this is also found only among the higher mountain ranges, and is probably confined to the Sub-region.

Among the Rodents of this Sub-region there are two genera peculiar. One of these is *Eupetaurus*, a flying squirrel, which, unlike all others of the same group, lives in a part of the world practically devoid of forests. It is as yet known only from the extreme north-western part of the Indian Empire, but doubtless has a wider range. The second endemic genus, *Typhlomys*, has been formed for the reception of a curious, almost blind Mouse of Northern China.

Among the Carnivora of the Chinese Sub-region the only genus of very special interest is *Æluropus*, which has already been mentioned in the general account of the Region. The Insectivora of this Sub-region are numerous, comprising as they do ten genera, of which three are endemic. These are all of them Shrews, two of which, *Chimarrhogale* and *Nectogale*, are aquatic forms with webbed toes, while the third, *Anurosorex*, is probably fossorial. All the Bats belong to fairly wide-spread forms.

Finally, there are two genera of Monkeys represented in this Sub-region, *Macacus* and *Semnopithecus*, but these forms belong strictly to the Oriental Region.

Below is a table of the genera of the Sub-region, arranged as in the foregoing Sub-regions, which shows what a considerable number of forms are common to this and the Oriental Region.

CHINESE SUB-REGION

	Ungulata.	Rodentia.	Carnivora.	Insectivora.	Chiroptera.	Primates.	Total.
Endemic	0	2	1	3	0	0	6
Palæarctic	2	1	1	0	0	0	4
Palæarctic and Oriental	4	1	3	3	1	2	14
Old World	3	4	0	2	5	0	14
Holarctic	0	4	0	2	1	0	7
Widespread	4	5	6	0	3	0	18
Total	13	17	11	10	10	2	63

SECTION VII.—THE PAST HISTORY OF THE PALÆARCTIC MAMMAL-FAUNA

Although the palæontological history of Europe, so far as it has been worked out, has been very thoroughly investigated, our knowledge of its extinct mammals, at any rate, is not to be compared with that which has been acquired in the Nearctic Region. This is probably due, to a great extent, to the comparative rarity on this side of the Atlantic of fresh-water lake deposits, the examination of which, in North America, has produced such astonishing results.

Passing over the Mesozoic Mammals, which throw very little light on any of the problems involved in the present case, we find in the earliest Eocene beds scanty remains of a fauna containing hardly any members of the existing orders of Mammals. In their place is a series of forms closely resembling one another in possessing five-toed and

plantigrade extremities, furnished with neither hoofs nor claws, but with structures somewhat intermediate between the two. Nevertheless, even among these primitive mammals, it is possible to recognize the germs of the marked characters which at the present day separate the various Orders. In North America, in beds of the corresponding age, a much more ample stock of remains of a similar fauna is met with. Later on, in the Upper Eocene beds a much larger number of Mammals appears, this fauna containing at least a hundred genera, most of them of large size, whereas to-day the European Mammal-fauna consists only of fifty-four genera, and of these more than half are of small size. At this epoch slight distinctions between the European and American forms begin to appear, showing that even at these early times there was a commencing separation between the two great continents. In the earlier part of the Miocene age, so far as we know, no very great changes take place, but at the end of Miocene time we find in several localities wonderful assemblages of fossil Mammals in great abundance and in an excellent state of preservation, which enable us to make a better comparison. Such localities have been discovered at Pikermi in Greece, in the island of Samos in the Ægean Sea, at Maragha in Persia, and, perhaps the most important of all of them, in the Sivalik Hills at the southern base of the Himalayas.

This fauna bears a close resemblance to that of the Ethiopian Region in the present state, especially as regards the presence of Giraffes, Gazelles, and other Ungulates. North of the Alps this fauna, although represented, is not nearly so rich, many of the Antelopes and Giraffes being absent and being replaced by various forms of Deer

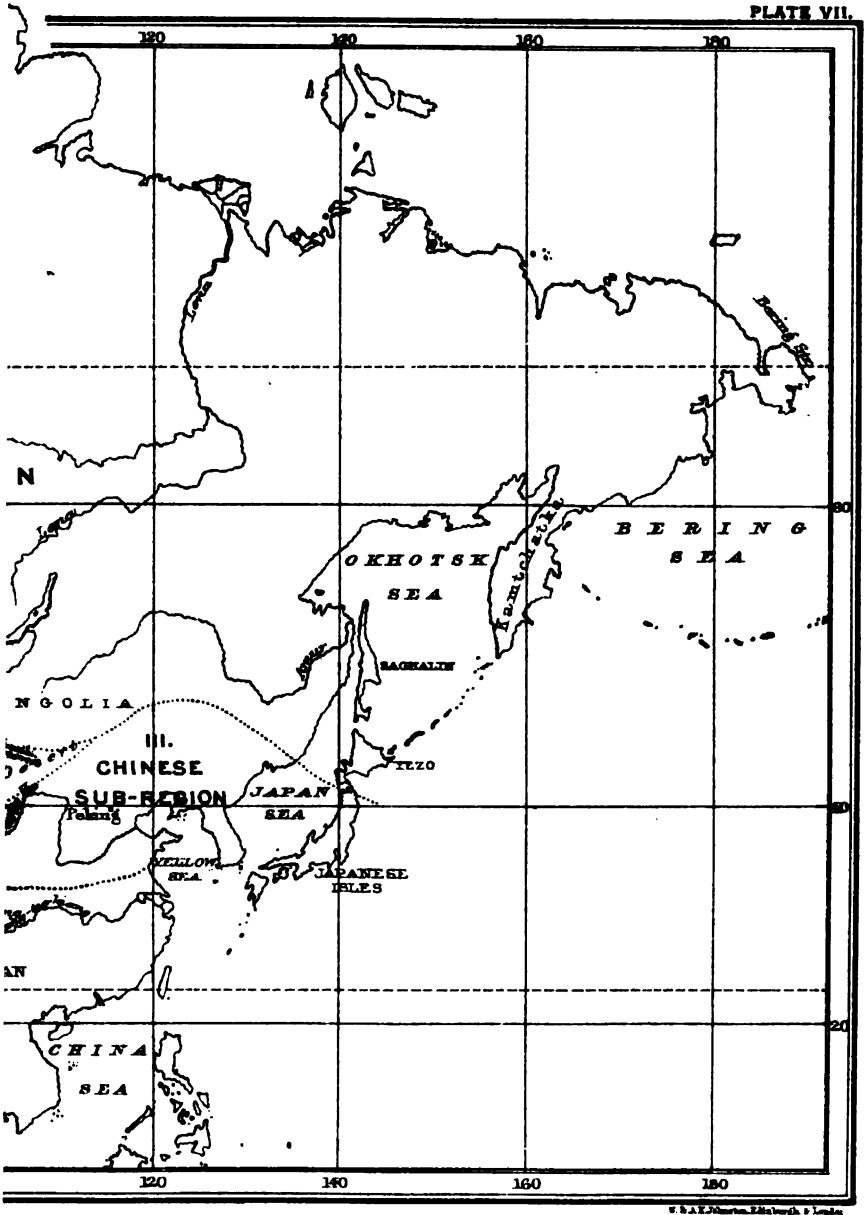
(*Cervidæ*), which now commence to be very much more prominent. In the true Sivalik fauna of India there are a good many types which have never yet been found in Europe; such, for instance, as the Camels, which are specially characteristic of the American Tertiary strata. Furthermore, there are found, in the American formations of this age, a large number of forms, such as *Bos*, *Equus*, *Hippopotamus*, and *Ursus*, which do not appear at all in Europe until the later Pliocene times.

When the Pliocene times arrive, we begin to find a preponderating number of still existing genera present in the fossil beds, although the greater number of them have, at the present epoch, retreated southwards into the Oriental and Ethiopian Regions. This southward migration seems to have gone on throughout the Pliocene period, and was probably occasioned by the increasing cold caused by the gradual advent of the great Ice-age, which now began to make itself felt over the whole of the northern part of the globe.

Finally, during the Glacial period the fauna assumed nearly its present form, containing large numbers of species that still survive. At this epoch, too, a connection appears to have been formed between the Old and New Worlds in the neighbourhood of Behring Strait, by means of which an interchange of animals took place, and resulted in occasioning the similarity which forms so marked a feature on a comparison of the Nearctic and Palæarctic faunas.

It is this similarity that has caused certain writers on geographical distribution to unite the Palæarctic and Nearctic Regions into one, whereas, as a matter of fact, palæontological evidence seems to show that, out of all the

four Regions embraced under the term "Arctogæa," the North American or Nearctic Region was the first to be separated from the main mass, and that the similarity is a comparatively modern element in the character of the two faunas.



DIVISION INTO 8 SUB-REGIONS.

CHAPTER VIII

MARINE MAMMALS

(PLATE VIII., p. 216)

SECTION I.—INTRODUCTORY REMARKS

MOST of the recent writers on geographical distribution have confined their attention to terrestrial Mammals, or at any rate have but casually alluded to the marine groups of that Class. The seven previous chapters having been devoted to the terrestrial Mammals, it is proposed now to examine the principal facts connected with the distribution over the world's surface of the Marine or aquatic members of the Class.

Aquatic Mammals which pass their lives entirely, or for the greater part, in the water are, of course, subject to very different laws of distribution from the terrestrial forms. As regards aquatic Mammals, land is of course an impassable barrier to their extension, and, subject to restrictions in certain cases, water offers them a free passage. Just the opposite is the case with the terrestrial Mammals, to which in most cases land offers a free passage, while seas and rivers restrain the extension of their ranges.

The groups of aquatic Mammals that are represented on the earth's surface at the present time are three in number, viz.: (1) the Sub-order of the Carnivora, containing the Seals and their allies, generally called the Pinni-

peds, which are semi-aquatic; (2) the Sirenia, or Manatees, which are mainly aquatic; and (3) the Cetacea, or Whales, which never leave the water, and are wholly aquatic. We will first consider briefly the principal representatives of these three groups, following nearly the arrangement of them employed in Flower and Lydekker's "Mammals Living and Extinct."

Section II.—Distribution of Pinnipeds

The Pinnipeds, which we will take first, comprise three distinct families—the *Otariidæ*, the *Trichechidæ*, and the *Phocidæ*. Beginning with the *Otariidæ*, or Eared Seals, commonly known as Sea-lions and Sea-bears, we find the greater number of the species confined to the South Polar Ocean, where they pass most of their time at sea, but, as is well known, resort to the land at certain seasons for breeding purposes. In the Atlantic Ocean, so far as is known, the Eared Seals have never been ascertained to occur much further north than the estuary of the La Plata on the American coast, where the Patagonian Sea-lion (Fig. 41, p. 199) is met with, and the vicinity of the Cape on the African coast, where *Otaria pusilla* is found. But in the Pacific, on the contrary, three distinct species of *Otaria* are distributed all over the northern portion of that ocean. Two species of Sea-lions are also met with in the Galapagos, and they likewise occur on the coasts of Peru and Chili. I think therefore we may assume that *Otaria* was originally an Antarctic form, but has travelled northwards along the West-American coast and is now firmly established in the North Pacific. In a parallel way in the Class of Birds,

the Albatrosses (*Diomedea*), which is essentially a group of the Antarctic Seas, are represented by three distinct species in the North Pacific.

The second family of the marine Carnivora, on the other hand, the Walruses (*Trichechidæ*), are entirely Arctic in their distribution—one species (*Trichechus rosmarus*)

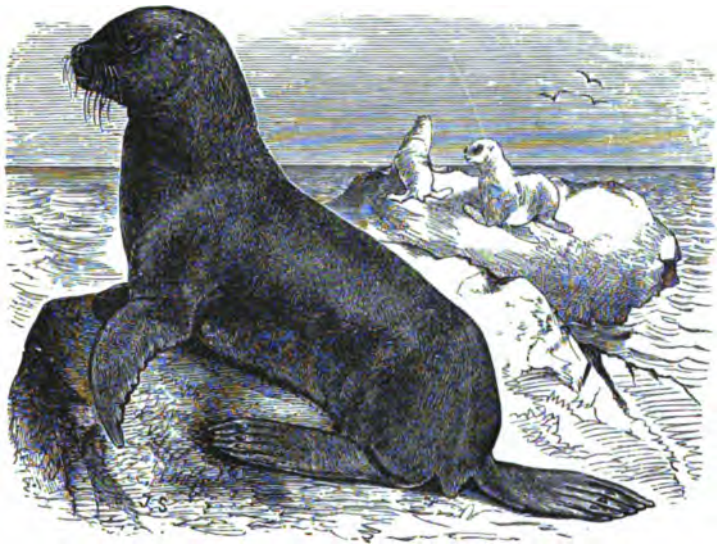


FIG. 41.—THE PATAGONIAN SEA-LION.

(*Otaria jubata.*)

[*P. Z. S.* 1866, p. 80.]

(see Fig. 42, p. 200) being peculiar to the North Atlantic, a second nearly allied species (*T. obesus*) takes its place in the Northern Pacific.

The third family of Pinnipeds is more numerous and varied, both in genera and species, than the two preceding, and has a more extended range. The Seals, *Phocidæ*,

embracing about nine different generic forms, are most numerous in the Arctic and Antarctic Seas, but are also feebly represented in some intermediate localities. Beginning with the North Atlantic, we find several species of *Phoca* (Fig. 43, p. 201), inhabiting various parts of this area, and the Grey Seal (*Halichœrus*) and the Bladder-Seal

FIG. 42.—THE ATLANTIC WALRUS.
(*Trichechus rosmarus.*)

(*Cystophora*) exclusively confined to it. In the North Pacific all the four true Seals belong to the genus *Phoca*, and three of them are identical with the North Atlantic species; but when we descend as far south as the Gulf of California on the American coast we meet with a species of Sea-elephant (*Macrorhinus*) which, like *Otaria*, has no

doubt penetrated thus far from its ancestral abode in the Antarctic Ocean.

Returning to the central Atlantic we find two species of Seals inhabiting these waters, both belonging to the same genus, *Monachus*. One of these (*M. albiventer*) inhabits the Mediterranean and the adjoining coasts of the Atlantic,

FIG. 43.—THE COMMON SEAL.
(*Phoca vitulina.*)

while the other (*M. tropicalis*) is in these days restricted to some of the smaller and less known islands of the West Indies.

The *Phocidæ* of the Antarctic Ocean all belong to genera distinct from the Arctic forms and more nearly allied to *Monachus*, the Seal of the Mid-Atlantic. They are of four species, belonging to as many genera: *Ogmorhinus*,

Lobodon, *Leptonychotes*, and *Ommatophoca*. Besides these the Sea-elephant of the whalers (*Macrorhinus*) is essentially an Antarctic form, though now nearly extinct there, after

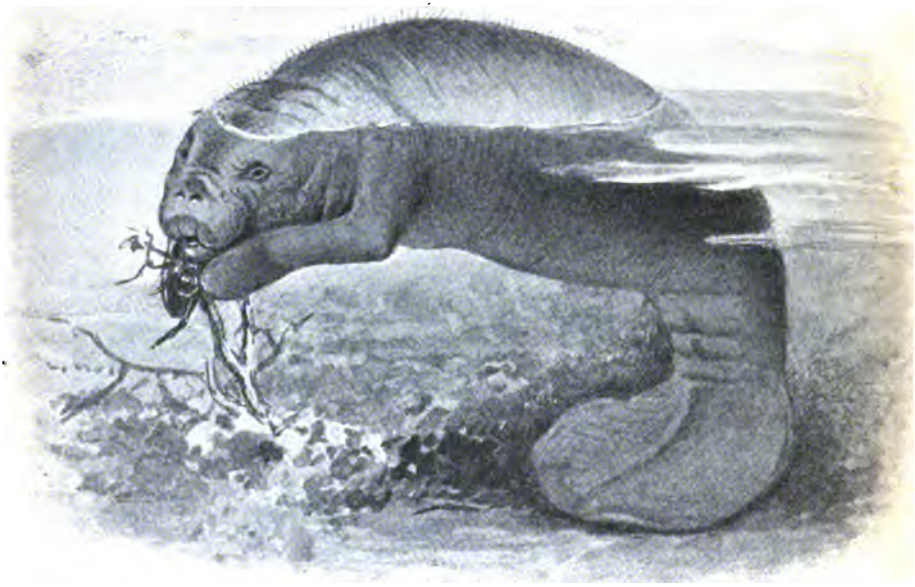


FIG. 44.—THE MANATEE.

(*Manatus americanus*.)

long persecution by man. But, as already noted, it extends. or has in former days extended, far up the west coast of America, and is still occasionally found on the coast of California.

Section III.—Distribution of Sirenians

Only two forms of Sirenians are at the present time existing on the earth's surface—the Manatee (*Manatus*)

Fig. 45.—The Dugong.
(*Halicore dugong.*)

and the Dugong (*Halicore*)—each representing a distinct family of the Order. The Manatee (Fig. 44, p. 202) is an inhabitant of the coasts and estuaries of both sides of the middle Atlantic Ocean—one species (*Manatus senegalensis*) occurring on the African shores, and another (*M. ameri-*

canus) on the South American coast and in the Antilles. A third species (*M. inunguis*), so far as we know at present, is found only in fresh water high up the Amazon.

The Dugong (*Halicore*) (Fig. 45, p. 203) is distributed from East Africa, along the shores of the Indian Ocean and its islands, to North Australia. Three species of this genus have been established—*Halicore tabernaculi* from the Red Sea, *H. dugong* from the Indian Ocean, and *H. australis* from Australia; but it is doubtful how far these forms are actually distinguishable.

FIG. 46.—THE RIGHT WHALE.

(*Balæna mysticetus.*)

[Flower and Lyd. Mamm., p. 236.]

Besides *Manatus* and *Halicore*, a third quite distinct form of Sirenian was formerly an inhabitant of the North Pacific. This was Steller's Sea-cow (*Rhytina stelleri*), by far the largest animal of the group, which was exterminated by human agency about 1768. Fortunately recent researches in Behring's Island have been successful in supplying specimens of its skeleton for our principal museums, and Steller, its discoverer, left to posterity a good account of its habits and anatomy.

Section IV.—Distribution of Cetaceans

Adopting the recognized division of the Cetaceans into two sub-orders, Mystacoceti and Odontoceti, according as to whether their mouths are furnished with baleen ("whalebone") or teeth, we will first consider the True or Whalebone Whales, which consist of a single family Balænidæ, usually divided into five genera: *Balæna*, *Neobalæna*, *Rhachianectes*, *Megaptera*, and *Balænoptera*. Of these,

Fig. 47.—The Sperm Whale.

(*Physeter macrocephalus.*)

[Flower and Lyd. Mamm., p. 249.]

Balæna (Fig. 46, p. 204), *Megaptera*, and *Balænoptera* are almost cosmopolitan—species of them, whether distinct or not is at present more or less uncertain, being met with in nearly every part of the ocean. But *Rhachianectes* has as yet been ascertained to occur only in the Northern Pacific, and *Neobalæna* in the South Polar Ocean, so that we have in these cases two well-marked local types to deal with.

The Toothed Whales (Odontoceti) are more diversified than the preceding group, and are usually held to embrace at least four existing families besides extinct forms.

The first family, containing the Physeteridæ or Sperm-Whales, consists of at least six genera, *Physeter* (Fig. 47, p. 205), *Cogia*, *Hyperoodon*, *Ziphius*, *Mesoplodon*, and *Berardius*). *Physeter* and *Cogia* are inhabitants of the whole oceanic area between the tropics, extending in certain localities some way beyond them. *Hyperoodon* is confined to the North Atlantic. *Ziphius* has an extensive range, and has been found in nearly every part of the ocean. *Mesoplodon* is also widely distributed, but is apparently more abundant in the Southern Hemisphere. *Berardius*,

FIG. 48.—THE SEE-SEE.

(*Platanista gangetica.*)

[Flower and Lyd. Mamm., p. 255.]

however, so far as we know at present, is restricted to the Pacific Ocean.

The second (existing) family of Toothed Whales contains only the *Platanistidæ*, or Freshwater Dolphins, which although, in some cases, at the present day entirely fluviatile, must probably have descended from oceanic forms.[1] The three known genera are *Platanista* of the Ganges and Indus (Fig. 48), *Inia* of the river Amazon, and *Pontoporia* of the river La Plata; the last form making

[1] Sir William Flower ("Whales, Past and Present," *Proc. Roy. Inst.*, x., p. 360, 1883) rather favours the idea of a freshwater origin of the Cetaceans.

a connecting link between the two preceding genera and the marine Dolphins.

The third family of Toothed Whales, containing the Dolphins, *Delphinidæ*, is very numerous in species and embraces at least fifteen or sixteen genera, of which the Common Dolphin (Fig. 49) is a good example. But in spite of the efforts of Mr. True, who has recently given us an excellent summary of our present knowledge of them,[1] both the genera and species of *Delphinidæ* are still so imperfectly understood that not much can be said about their geographical distribution. Most of the forms

FIG 49.—THE COMMON DOLPHIN.

(*Delphinus delphis.*)

[Flower and Lyd. Mamm., p. 271.]

appear to be very widely distributed, but it may be said generally that Dolphins are most abundant in the intertropical seas and less plentiful both to the north and south of them.

There are, however, two forms that are exclusively inhabitants of the Northern Oceans. These are the very remarkable Narwhal (*Monodon*), in which the male is furnished with a single enormous horn-like tusk, and the Beluga, or White Whale (*Delphinapterus*), closely allied

[1] See "A Review of the Family Delphinidæ," by Frederick W. True. *Bull. U.S. Nat. Mus.*, No. 36 (Washington, U.S., 1889).

to the Narwhal in many points of its general structure (Fig. 50). These may be looked upon as quite isolated

FIG. 50.—THE BELUGA.

(*Delphinapterus leucas.*)

[Flower and Lyd. Mamm., p. 262.]

forms characteristic of the Arctic portion of the Atlantic and Pacific.

SECTION V.—DIVISION OF THE MARINE AREA OF THE GLOBE INTO SEA-REGIONS

From what has been already said, it will be evident that although many of the marine mammals have a wide distribution, others are very definitely localized; and a study of the latter will enable us to divide the oceanic portion of the globe into six Sea-regions, corresponding to a certain extent with the six Land-regions already discussed. It is proposed to name these Sea-regions, which are shown in the map (Plate VIII., p. 216), as follows:—

(1) The *North Atlantic Sea-region*, or *Arctatlantis* (ἄρκτος and Ἀτλαντὶς = the daughter of Atlas), consisting of the northern portion of the Atlantic down to about 40° N. lat.

(2) The *Mid-Atlantic Sea-region*, or *Mesatlantis* (μέσος and Ἀτλαντὶς), consisting of the middle portion of the Atlantic down to about the Tropic of Capricorn.

(3) The *Indian Sea-region*, or *Indopelagia* (Ἰνδος and πέλαγος), containing the Indian Ocean down to about the same degree of S. lat., and extending from the coast of Africa on the west to Australia and the great Oriental islands on the east.

(4) The *North Pacific Sea-region*, or *Arctirenia* (ἄρκτος and εἰρήνη = pax), containing the northern portion of the Pacific Ocean down to about the Tropic of Cancer.

(5) The *Mid-Pacific Sea-region*, or *Mesirenia* (μέσος and εἰρήνη), containing the inter-tropical portion of the Pacific Ocean; and finally,

(6) The *Southern Sea-region*, or *Notopelagia* (νότος and πέλαγος), containing the whole of the South Polar Ocean all round the globe south of the above-mentioned limits.

We will now proceed to consider shortly the characteristic mammals of these six Sea-regions.

Section VI.—The North Atlantic Sea-region, or Arctatlantis

Amongst the Pinnipeds two well-marked generic forms, the Grey Seal (*Halichœrus*) and the Bladder-Seal (*Cystophora*), are exclusively confined to Arctatlantis. The True Seals (*Phoca*) and the Walrus (*Trichechus*) are found in this region and in Arctirenia; and of the former genus three species (*P. vitulina*, *P. grœnlandica*, and *P. barbata*) are actually common to both these Sea-regions, while the Walruses (*Trichechus rosmarus* and *T. obesus*) of the two Sea-regions are perhaps somewhat doubtfully distinguishable. It may be easily understood how this has come to pass,

because the Seals and Walrus in the course of time, during unusually mild summers, may have extended themselves along the north coast of the American continent into the Northern Pacific. But Arctirenia, as we shall presently show, is markedly distinguishable from Arctatlantis by the presence of Eared Seals (*Otaria*), which are utterly unknown in the whole of the Atlantic area. *Otaria* is in fact, as regards Arctatlantis, a lipomorph.

The Sirenians are entirely absent from the North Atlantic and constitute another lipomorph of that area.

Coming to the Whales, we find the *Mystacoceti* well represented in the North Atlantic by *Balæna*, *Megaptera*, and *Balænoptera*; but of these the two latter are almost universally distributed over the ocean, and *Balæna* recurs again in the North Pacific as well as in more southern latitudes, so that there is no genus of Whalebone Whales peculiar to Arctatlantis.

Proceeding to the *Odontoceti*, the case is different. Amongst the *Physeteridæ*, *Hyperoodon* is confined to Arctatlantis. Arctatlantis therefore may be said to be well characterized by the possession of at least three genera of marine mammals not found elsewhere, viz., *Halichœrus*, *Cystophora*, and *Hyperoodon*, and by the complete absence of the Eared Seals (*Otariidæ*).

Section VII.—The Mid-Atlantic Sea-region, or Mesatlantis

Mesatlantis has certainly not so many forms of marine mammals confined to its area as Arctatlantis, but there seem to be good grounds for its separation. As we descend

towards the tropics the true Seals (*Phocinæ*), which are constituted to live in colder water, gradually fall off in number, and in Mesatlantis are no longer met with. But in their place we find the genus *Monachus*, or Monk-Seal, restricted to Mesatlantis, one species (*M. albiventer*) occurring in the Mediterranean and on the North African coast, and a second (*M. tropicalis*) being found in the West Indies. Mesatlantis is likewise the true home of the well-marked Sirenian genus *Manatus*, one species of which (*M. americanus*) frequents the coast of America and another (*M. senegalensis*) that of Africa.

As regards the Cetaceans, we are not at present able to say that Mesatlantis, although well furnished with many generic types of this Order, has any one peculiar to it. We must therefore rest content with assigning two genera of marine mammals, *Monachus* and *Manatus*, as characteristic forms or topomorphs of the Sea-mammal-life of Mesatlantis.

Section VIII.—The Indian Sea-region, or Indopelagia

The marine Carnivora, so far as we know, are entirely foreign to Indopelagia, but the Sirenians are well represented by the Dugong (*Halicore*), which pervades all its northern coasts from North Australia to India and the Red Sea and down the African coast to the confines of British East Africa. Whether the species of *Halicore* found at different points within this area are the same or different is still a matter of discussion, but there can be no doubt that *Halicore* is an exclusive inhabitant of

Indopelagia. As regards the Whales of Indopelagia, we know that *Physeter*, *Cogia*, and *Ziphius*, and numerous forms of *Delphinidæ* occur there, but are not aware of any Cetacean that is entirely restricted to this Sea-region.

Section IX.—The North Pacific Sea-region, or Arctirenia

As was pointed out when speaking of Arctatlantis, Arctirenia has one genus of *Phocidæ* (*Phoca*) in common with the North Atlantic, and three of the species of this genus appear to be actually identical in these two Sea-regions, whilst a fourth *Phoca* (*P. fasciata*) is only found in the North Pacific. The Walrus (*Trichechus*) is again a form of marine mammals common to both the great northern Sea-regions. But the feature of Pinnipedian life that absolutely distinguishes Arctirenia from Arctatlantis is the presence in the former of three (if not four) well-marked species of the Eared Seals (*Otariidæ*), which are absolutely unknown in the vast extent of the Atlantic down at least to 30° S. lat.

Arctirenia has unfortunately lost its Sirenian, Steller's Sea-cow (*Rhytina stelleri*), the largest modern representative of this formerly prevalent group, which since the days of the Pleistocene has greatly diminished in numbers, but I think we may still treat *Rhytina* as one of the characteristic forms of the Arctirenian Sea-region. The North Pacific is also, even at the present day, the sole possessor of a remarkable genus of Whalebone Whales which combines the long head and elongate form of *Balæonptera* with the absence of the dorsal fin of *Balæna*.

This is the Grey Whale, *Rhachianectes glaucus* of Cope, which, in these days, is confined to the North Pacific, and does not range farther south than the 20th parallel in that ocean. At the same time it should be stated that indications have been discovered that a nearly allied form existed in the Atlantic in previous geological ages, though this is by no means certain. Besides *Rhachianectes*, *Balæna*, *Megaptera*, and *Balænoptera* are all represented in the North Pacific, and also many species of *Delphinidæ* of which little is at present known. But *Rhytina* and *Rhachianectes* are the only genera of Marine Mammals absolutely confined to Arctirenia.

Section X.—The Mid-Pacific Sea-region, or Mesirenia

The Eared Seals, *Otaria*, must have necessarily passed through Mesirenia in their passage from south to north, though the only record of their actual presence in the central part of the Pacific is, so far as we know, the recent discovery of them in the Galapagos. It should be stated, however, that Tschudi records the occurrence of two species of *Otaria* on the islands of the coast of Peru, and that in 1802 Humboldt met with an Eared Seal on the Island of San Lorenzo, in the Bay of Callao, which is only some 12° south of the Equator.

Like *Otaria*, the Sea-elephant (*Macrorhinus*) has apparently in former ages travelled up the South American shores and established itself as far north on the coast of California as about 34° N. lat. The Californian Sea-elephant has been discriminated by Gill as a distinct

species (*Macrorhinus angustirostris*), but its differences from the southern form (*M. leoninus*) seem to be but trifling.

As regards the Cetaceans of Mesirenia, our information is at present very imperfect, and there is little to say except that species of *Megaptera*, *Balænoptera*, *Physeter*, *Cogia*, and *Ziphius* certainly occur there, besides many representatives of the widely spread *Delphinidæ*.

Section XI.—The Southern Sea-region, or Notopelagia

The wide ocean which surrounds the Southern Pole on every side, and extends up to 40° S. lat., seems to present, as regards its marine mammals, a nearly homogeneous fauna, which we will now briefly consider. In the first place it contains representatives of four genera of true *Phocidæ* — *Ogmorhinus*, *Lobodon*, *Leptonychotes*, and *Ommatophoca*, which are peculiar to the southern seas, and are quite distinct from all their northern representatives in the Arctic Ocean. The Sea-elephant, *Macrorhinus*, is also a denizen of Notopelagia, though, as we have already seen, it has wandered north along the South American coast far into Mesirenia.

Like *Macrorhinus*, *Otaria* also, containing the group of Eared Seals, appears to have been originally an Antarctic group, and the greater number of its species are still found in the Southern Ocean. But the *Otariæ* have travelled still further north than *Macrorhinus*, and three, if not four, species are, as already stated, in these days well-established inhabitants of Arctirenia.

The Sirenians are absent from Notopelagia, but Cetaceans of every kind are abundant. Besides one or more representatives of the true Whalebone Whale (*Balæna*), Notopelagia has a smaller representative of the group (*Neobalæna*) entirely restricted to its area. It has also representatives of *Megaptera* and *Balænoptera*, though it is doubtful how far they are even specifically distinct from some of their northern representatives.

Among the Toothed Whales (*Odontoceti*) we find a large Ziphioid form, *Berardius*, restricted to the Pacific area, while *Ziphius* and *Mesoplodon* also occur there. The Dolphins (*Delphinidæ*) are likewise numerous, and present some distinct species, but not, so far as our present knowledge extends, any generic forms that do not occur elsewhere.

But Notopelagia is sufficiently distinguished from all the five more northern Sea-regions by possessing four genera of Seals and two of Cetaceans entirely restricted to its area.

Section XII.—Conclusions

It has therefore been shown that, for the geography of marine mammals, the ocean may be conveniently divided into six Sea-regions (Plate VIII., p. 216), which are as follows:—

I. *Regio Arctatlantica*, characterized by its Seals (*Phocinæ*), of which two genera, *Halichœrus* and *Cystophora*, are peculiar, whilst *Phoca* is common to it and Arctirenia; by the absence of Sirenians; and by the possession of a peculiar genus of Cetaceans (*Hyperoodon*).

II. *Regio Mesatlantica*, sole possessor of the Monk-

Seals, *Monachus*, amongst the Pinnipeds, and of the Sirenian genus *Manatus*.

III. *Regio Indopelagica*, characterized by the presence of the Sirenian *Halicore* and by the absence of Pinnipeds.

IV. *Regio Arctirenica*, with *Phoca* like the *Regio Arctatlantica*, but having *Otaria* also; the home of the (now extinct) Sirenian *Rhytina* and of the endemic Cetacean *Rhachianectes*.

V. *Regio Mesirenica*, without true Seals (*Phocinæ*), but having *Otaria* and *Macrorhinus* from the south; no Sirenian being known there.

VI. *Regio Notopelagica*, characterized by four endemic genera of *Phocidæ*, and by the presence of many *Otariæ*; without Sirenians, but with two endemic forms of Cetaceans (*Neobalæna* and *Berardius*).

In conclusion, attention may be called to some of the more remarkable points in the general distribution of the marine mammals and to their apparent significance.

In the first place it is evident that the Pacific has much more in common with the Notopelagian Region than the Atlantic. *Otaria* and *Macrorhinus*, quite unknown in the Atlantic, extend themselves to the northern extremity of the Pacific, the former pervading that ocean up to Behring's Strait, and the latter reaching to the Californian coast. It follows that in former ages there must have been some barrier in the Atlantic which did not exist in the Pacific to stop their progress northwards. The only barrier one can imagine that would have effected this must have been a land uniting South America and Africa, across which they could not travel. Adopting this hypothesis, we have at the same time an explanation of the presence of the Manatee on both the American

and African coasts. The Manatee could hardly live to cross the Atlantic. It is only found close to the coast, in estuaries and rivers, where it browses on sea-weeds and other vegetable food in shallow water. How did it travel from America to Africa (or *vice versâ*), unless there were a continuous shore-line between them? The same may be said of the Monk-Seal (*Monachus*), of which one species lives in the Mediterranean and on the African coast and islands, and another in the West Indies. We can hardly believe that these creatures could easily traverse the whole Atlantic. The hypothesis of a former barrier of land between Africa and America, which we know is supported by other facts of distribution,[1] would alone explain the difficulty.

On the other hand, in the Pacific we find no such break between the north and south. The aquatic mammals of Notopelagia have evidently had free access to the whole of the Pacific for a long period, and have well availed themselves of this facility.

Again, while the great Southern Ocean exhibits a considerable uniformity of marine mammalian life, we see the Northern waters divided into two distinctly recognizable Regions by the interposed masses of land. All these facts, with the one exception of the supposed Atlantic barrier, would tend in favour of the now generally accepted doctrine that the principal masses of land and water are not of modern origin, but have existed mainly in their present shapes throughout all ages.

[1] *Cf.* Wallace, Geogr. Distrib., vol. i., p. 156.

CHAPTER IX

DISTRIBUTION OF MONKEYS AND LEMURS

SECTION I.—INTRODUCTORY REMARKS

HAVING now completed the discussion of the great Zoological Regions of terrestrial and marine mammals and their leading peculiarities, it is proposed to take the subject in another way, and considering the Orders, or great primary groups of mammals, one after the other, to sketch out the mode in which their leading forms are distributed over the surface of the world. We shall then see whether the conclusions thus arrived at appear to lead to similar results to those attained by making geographical divisions our primary subject of study. In doing this it will be more convenient to take the most highly organized groups of mammals first, and to descend gradually to the lowest, reversing the arrangement used in the previous chapters of this work. The divisions and names now employed are taken from the last edition of the "List of Vertebrated Animals in the Zoological Society's Gardens," (1896), but do not differ materially from those used in Flower and Lydekker's "Mammals Living and Extinct," which we have hitherto mainly followed. These

divisions, commonly called "Orders," are fourteen in number, as follows:—

I. Quadrumana.
II. Lemures.
III. Carnivora.
IV. Insectivora.
V. Chiroptera.
VI. Rodentia.
VII. Hyraces.
VIII. Proboscidea.
IX. Ungulata.
X. Cetacea.
XI. Sirenia.
XII. Edentata.
XIII. Marsupialia.
XIV. Monotremata.

Section II.—General Distribution of the Quadrumana

The Order of Quadrumana, or Monkeys, of which about 200 species are now recognized, is generally divided by zoologists into four families: (1) the *Simiidæ* or Apes, (2) the *Cercopithecidæ* or Old-World Monkeys, (3) the *Cebidæ* or New-World Monkeys, and (4) the *Hapalidæ* or Marmosets. Of these families the two first are exclusively inhabitants of the tropical or sub-tropical districts of the Old World, while the two last are as severely restricted to the hotter portion of the New World, and form, in fact, two of the most characteristic groups of the Neotropical Region. We thus see that the division of the Quadrumana into families according to their structure is in complete accordance with the distinctness of the geographical areas in which they are found.

The two first and highest families of Monkeys, it should be remarked, are much more nearly allied to one another than they are to the two families which inhabit the New World. They are sometimes called "Catarrhines," on account of the narrowness of the nasal septum and the consequent downward direction of the nostrils. They all

agree together in possessing the same number of teeth and the same general structure of these organs as Man, who, if considered only from a material point of view, must certainly be referred to the same group of animals.

On the other hand, the two families of Quadrumana belonging to the New World have each of them a dentition peculiar to themselves and different from that of the Catarrhine Monkeys, to which they are inferior in every point of organization. The first of these two families, the *Cebidæ*, have been designated "Platyrrhines," in reference to the broad septum which separates the nostrils from each other, and thus distinguishes them from the Catarrhine Monkeys of the Old World. The second family of New World Monkeys, the Marmosets, are unquestionably the lowest of the Quadrumana, and have some superficial resemblance to the Squirrels and other Rodents.

Section III.—Distribution of the Old World Monkeys

The Catarrhine Monkeys, as already stated, are restricted to the Old World, and in present days, as we shall see, mainly to the tropics, though a few species are found farther north, and other forms, now extinct, have left their remains in the tertiary and post-tertiary formations of more temperate countries.

The Catarrhine Monkeys form two families, the *Simiidæ* or Man-like Apes, and the *Cercopithecidæ* or Monkeys proper. The Man-like Apes, in the present condition of the world's surface, are confined entirely to the equatorial Regions of Africa and Asia. They are usually

referred to three genera: (1) *Anthropopithecus*, which embraces the Black Apes of tropical Africa, (2) *Simia*, which contains the Brown Apes of tropical Asia, and (3) *Hylobates*, which contains the Gibbons, likewise restricted to tropical Asia.

It has been a subject of much discussion among zoologists as to which of these three forms of Simiine life comes nearest to man in structure. Some have advocated the claims of the Orang to this distinction, but it is now generally held that his black cousins of the Ethiopian Region ought to be placed at the head of the series. It has likewise been maintained by some authorities that in certain respects the Gibbons (*Hylobates*) come nearer to man than either of the above-mentioned forms, but this opinion has not met with general support. We will therefore commence our survey of the distribution of the Anthropoid Apes with their African representatives, the Chimpanzee and the Gorilla.

The Chimpanzee (*Anthropopithecus troglodytes*) is certainly widely spread over tropical Africa, but we have not as yet acquired sufficient details as to the exact limits of its distribution. Nor are naturalists at all agreed as to whether one or more species are comprehended under the name of Chimpanzee, though it is generally allowed that the Bald-headed Chimpanzee (*A. calvus*), a well-known specimen of which lived in the Zoological Society's Gardens for many years, must be considered distinct from the ordinary *A. troglodytes*. But in examining the distribution of the Chimpanzee it is hardly necessary to seek to determine this vexed question more nearly.

Commencing on the western coast of Africa, the range of the Chimpanzee appears to begin with the wooded

districts somewhat to the south of the river Gambia, and to continue all down the coast-region into Angola, south of the Congo. Here the dry and open country of south-west Africa commences, and, as the Chimpanzee is essentially a forest animal, it could not be expected to be met with farther in this direction. The Chimpanzee in its inland range appears to extend over the whole wood-district of the great Congo valley, and in the Niam-Niam country, perhaps, passes over into the basin of the Nile. It was heard of by Livingstone in the forests on the western side of Lake Tanganyika where it is said to be called "Soko," and the late Emin Pasha sent to England the skull of a Chimpanzee stated to have been shot by himself near Lake Albert Nyanza, which seems hardly to differ from the West African form. Whether Emin Pasha's assertion that the Chimpanzee occurs in Uganda and Unyoro up to 32° E. lat. is correct is very doubtful. It seems to have been made on native authority, and has not, so far as we are aware, been corroborated by more recent travellers. But as regards its existence in the Niam-Niam country we have Emin Pasha's express statement that he received a living specimen of the Chimpanzee as a present from one of the chiefs of that nation.[1]

The Gorilla (*A. gorilla*), which by some authors is referred to a different genus from the Chimpanzee although its general structure is not materially different, is confined to a very much more limited area than that of its smaller brother (*A. troglodytes*). So far as we know at present, it seems to be entirely restricted to Gaboon and the adjacent districts of French Congo. Whether the extraordinary accounts formerly given of the strength and

[1] "Emin Pacha in Central Africa," p. 355.

ferocity of the Gorilla are based on fact seems to be still quite doubtful. The few specimens of this animal that have reached Europe alive have not given much support to the stories told about it.

The genus *Anthropopithecus*, therefore, with its two, or perhaps three, species, may be regarded as one of the most characteristic forms of the mammal-life of the Ethiopian Region to which it is absolutely confined.

Passing on to the next genus of Anthropoid Apes, we find that the Orangs (*Simia*) are in like manner one of the most characteristic mammal-forms of the Indian Region, to which they exclusively belong. As in the case of the Chimpanzee, there has been the same difference of opinion among naturalists as to whether there is only one or several species of Orangs. The Orang is found only in the dense forests of Borneo and Sumatra. The forms met with in these islands respectively have been treated as specifically distinct, and the Bornean form has also been divided into several species. But, on the whole, the prevalent opinion of modern writers is that there is only one variable species of Orang, which we call by Linnæus' name *Simia satyrus*. In Sumatra this Ape is mainly found in the lowlands of the eastern coasts of the island, in the districts of Palembang and Jambe. In Borneo it is more numerous, and has a wider range, extending all over the low forest-covered swamps between the coasts and the mountains of the interior, but in some places ascending to a considerable height in the lower hills.

The third and only remaining genus of Anthropoid Apes contains the Gibbons, or Long-armed Apes (*Hylobates*), which are likewise restricted to the Oriental Region, but have a much wider distribution than the Orang. The

Gibbons vary much in the colour of their fur, and numerous doubtful species have been based upon such differences. The most recent authorities are not inclined to allow more than seven or eight well-marked species of Gibbons. Of them the most distinct is the Siamang (*Hylobates syndactylus*) of the Malay Peninsula and Sumatra, which has the second and third toes of the feet joined together by a thin web of skin, and has other slight peculiarities, which have induced some naturalists to place it in another genus. But this seems to be quite unnecessary. The remaining typical Gibbons are thinly distributed over all the three great islands of the Malay Archipelago, Sumatra, Java, and Borneo, extending into the Sulu group between Borneo and the Philippines. On the continent they range high up the Malay Peninsula, even so far north as Assam and Bhootan, where they are represented by the Hoolock (*H. hoolock*). They are also found in Siam, Cambodia, and Annam, and one species (*H. hainanus*), has been discovered in the Chinese island of Hainan.

Thus of the three generally recognized genera of *Simiidæ*, or Anthropoid Apes, one is of the Ethiopian, the two others of the Oriental Region.

We now come to the second family of Catarrhine Monkeys, the *Cercopithecidæ*, or what are usually called the Old World Monkeys. Of these, about one hundred and twenty species are known, divisible into about nine well-marked genera. Most of these monkeys, as we shall show, belong to the Oriental and Ethiopian Regions, but the genera which inhabit these Regions respectively are quite distinct. Two genera alone, *Macacus* and *Semnopithecus*, have representatives within the limits of the Palæarctic Region.

The Langurs (*Semnopithecus*) of the Oriental Region,

which we will take first of the group, remarkable for their slender body and the excessive length of their tails, are distributed over Southern Asia and the adjoining islands of the Malay Archipelago, and are numerous in species, as many as twenty-nine or thirty being of probable validity. Dr. Blanford describes as many as fourteen of them in his "Fauna of British India," as met with within the limits of India, Ceylon, and Burma. Of these, one, *S. schistaceus*, has mounted high into the Himalayas, where it ascends to an elevation of 10,000 feet and is never met with below 5000 feet. But this species is undoubtedly derived from the plains of India, being a very close ally of *S. entellus*, which has a wide distribution over the northern provinces. Another well-marked species of this genus is found high up in Eastern Tibet and North-western China, where it inhabits the mountain forests and has been named *S. roxellanæ* from its conspicuous turned-up nose. Borneo, Sumatra, and Java, have each of them distinct species of this wide-spread genus.

Closely allied to the Langurs (*Semnopithecus*) is the very curious Long-nosed or Proboscis-monkey of Borneo, which seems to be confined to the lowlands near the mouths of the rivers in Sarawak and the adjoining districts of that island. It is the sole representative of the genus *Nasalis*.

Passing back to the Ethiopian Region, we find in the place of *Semnopithecus* and *Nasalis* the genus *Colobus*, remarkable for the absence of a thumb on its hand, but in other respects closely allied to its Asiatic brethren. About ten species of *Colobus* are generally recognized by naturalists. They are distributed all over the forests of tropical Africa, being, perhaps, most abundant on the west

coast. One of them, Kirk's Colobus (*C. kirki*) so far as has yet been ascertained, has been only met with in the island of Zanzibar, where, however, it is said to be now nearly extinct. Another well-marked species, the Guereza (*C. guereza*), is peculiar for its long-haired flanks and tail. It was originally discovered in Abyssinia, but is represented by closely allied forms in British East Africa and on the Niger and Upper Congo.

The Guenons, or long-tailed Monkeys of the genus *Cercopithecus*, which we now come to, are likewise entirely confined to the Ethiopian Region, and being exclusively inhabitants of forests, are naturally most numerous in the wooded districts of the west coast and in the great wooded valley of the Congo. They are very numerous in species, as many as forty different kinds having been discriminated, but are mostly confined to small specific areas, not more than one or two species as a rule occurring in the same district. Allied to the Guenons are the Mangabeys (*Cercocebus*) with about six known species, which has nearly the same area of distribution.

Both Guenons and Mangabeys do well in captivity, and are always well represented in the Zoological Society's monkey-house, where they have, in some cases, bred young ones. As many as twenty-four different species of *Cercopithecus* will be found registered in the Zoological Society's Catalogues, and amongst them are some of the most beautiful and brightly coloured of the Quadrumana, such as the Diana Monkey (*C. diana*) and Brazza's Monkey (*C. brazzæ*).

In the Oriental Region the corresponding form of monkey is the Macaque (*Macacus*), about fifteen species of which are distributed over Southern Asia and its islands

down to Wallace's Line. Some of these have a wide range, such as the Pig-tailed Macaque (*M. nemestrinus*) and the Crab-eating Macaque (*M. cynomolgus*), which occur in most of the large islands of the Indian Archipelago, as well as in the Malay Peninsula, but others are very limited in their specific areas. The Macaques ascend high in the Himalayas, *M. rhesus* or some of its allied forms going up to at least 10,000 feet above the sea-level. Moreover, two other nearly allied species of this genus are found to the north of the Himalayas, far beyond the limits of the Oriental Region. These are the Hairy-eared Macaque (*M. lasiotis*) of Szechuen, and the Tcheli Monkey (*M. tcheliensis*) of Manchuria. The latter inhabits the mountains of Yung-Ling, north of Pekin, in latitude 41° North, where the thermometer frequently descends to 10° below zero. An example of this rare monkey, which has been living in the Zoological Society's menagerie since June 1886, is always kept in a cage in the open air. A third species of Macaque (*M. speciosus*) is found in Japan, where it is the sole representative of the order Quadrumana. It is stated to be found all over the island of Hondo or Nippon up to 41° N. lat., and if this be the case, has a higher range north than any other monkey now existing, except perhaps the Tcheli Monkey just spoken of.

In the western part of the Palæarctic Region, a single species of Macaque is also found. This is the Barbary Ape (*M. inuus*), which frequents in the scrubby gorges of the mountains of Morocco and Algeria, and is also a well-known inhabitant of the Rock of Gibraltar. But whether it is an aboriginal denizen of "The Rock" or has been introduced by man is somewhat doubtful. At the present time,

being carefully protected by the authorities there, it is said to be increasing in numbers.

It appears, therefore, that at least three or four species of Macaque must be considered as inhabitants of the Palæarctic Region, while the remainder are confined to the Oriental Region.

The series of Catarrhine, or Old World Monkeys, is closed by the Baboons, of which three genera are now usually recognized, one from the Oriental and two from the Ethiopian Region. The Oriental form of Baboons is the Black Baboon of Celebes (*Cynopithecus niger*)—a feeble representative of its African relatives in the most distant borders of the Oriental Region. The Black Baboon is stated to be also found in Batchian and the Philippines, but may possibly have been introduced by man into these localities. In Africa the Gelada Baboon (*Theropithecus*), with two somewhat doubtfully distinct species, is restricted to the mountains of Abyssinia, while the true Baboons (*Cynocephalus*) are spread over the greater part of the Ethiopian Region. Of the eleven or twelve species of *Cynocephalus* usually recognized, the best known perhaps is the Arabian Baboon (*C. hamadryas*)—the Sacred Monkey of the ancient Egyptians, the likeness of which is of frequent occurrence among the engravings on the Egyptian temples and tombs. Besides the south-west portion of the Arabian Peninsula it inhabits also Abyssinia and extends into Upper Nubia. Another well-known Baboon is the Chacma (*C. porcarius*) of the Cape Colony. The proverbial unsightliness of the Baboons reaches its acme in the Mandrill (*C. mormon*) and Drill (*C. leucophæus*) both from West Africa.

Section IV.—Distribution of New World Monkeys

The Cebidæ, or Platyrrhine Monkeys, which we will now consider, are not so numerous as their cousins of the Old World, only from fifty to sixty species being usually recognized, although many of these are not very perfectly distinguished. They are also confined to much narrower limits than the monkeys of the Old World, being entirely restricted to the warmer portions of the Neotropical region, and, being purely arboreal in their habits, to those parts of it which are covered by dense forests. Their northern limit is Guatemala and the adjacent districts of Southern Mexico, the most northern locality for monkeys in the New World positively ascertained being about 23° N. lat., in the State of San Louis Potosi. This, it may be observed, is in striking contrast to the northern range of the Quadrumana of the Old World, which, as has been shown, extends to 41° N. lat. To the west of the Andes of South America monkeys are only found as far south as the Gulf of Guayaquil, the arid and treeless nature of the whole southern portion of the west coast being quite unsuitable for forest-loving animals. To the east of the Andes, however, monkeys extend all over the vast forests of the valleys of the Orinoco and Amazon and as far south as the wooded districts of Paraguay and the adjoining provinces of the Argentine Republic. Burmeister includes three species of Cebidæ in his list of the mammals of the La Plata States.

The New World Monkeys are usually divided into about nine genera, amongst which the Spider-Monkeys, (*Ateles*) occupy the highest position. The Spider-Monkeys

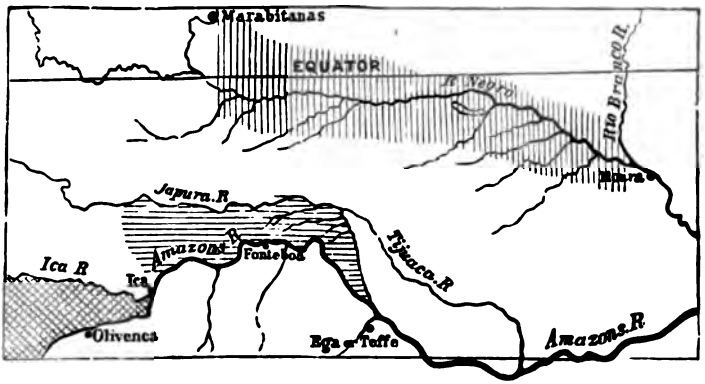
number about ten species, which are distributed over the whole area occupied by the family as above described, being most numerous, perhaps, in the great forests of Amazonia. Closely allied to *Ateles* are the Woolly Spider-Monkeys of the genus *Brachyteles*, which are confined to the forests of South-eastern Brazil. They have been divided into three species, but the prevailing opinion amongst modern naturalists is, that these are really only varying forms of one species.

The typical genus *Cebus*, which follows next in the series, numbers some eighteen or twenty species, many of which, however, are very imperfectly discriminated. This genus also has an extensive range, extending from Nicaragua to Paraguay, but being most numerously represented in Amazonia. With *Cebus* we close the first and most highly organized group of the New World Monkeys which constitute the first sub-family Cebidæ.

The second sub-family of the Cebidæ, the Mycetinæ, contains only the single genus *Mycetes* with about six species, commonly known as Howlers, from their extraordinary voices, produced by a specially modified vocal organ. The Howlers have also a wide distribution in the New World, one species, *M. villosus*, being found as far north as Guatemala, whilst another, *M. niger*, occurs in Paraguay.

The third sub-family of American Monkeys contains only two genera—the long and bushy-tailed Sakis (*Pithecia*) and the short-tailed Ouakaris (*Brachyurus*). Contrary to what is the case in the previous sub-families, the generic area of this group is much constricted, being confined to the basins of the Orinoco and Amazon and to Guiana, which is surrounded by them. The five or six known species of

Saki are all inhabitants of various localities within this district. The mode of distribution of the three species of Ouakari is still more remarkable. Each of them, as first shown by Bates and afterwards further explained by Forbes, is limited to a comparatively small tract of forest on the banks of the Amazon and its affluents. The Black-headed Ouakari (*B. melanocephalus*), as shown by the accompanying map (prepared by Forbes), which we



MAP OF THE SPECIFIC AREAS OF THE OUAKARIS.

(*P. Z. S.* 1880, p. 647.)

have been kindly permitted to use by the Zoological Society of London, is met with only in a tract traversed by the Rio Negro, the Bald-headed Ouakari appears to be confined to the triangle formed by the union of the Amazon with another affluent, the Japurà, and the Red Ouakari to the forests on the north bank of the Amazon opposite Olivença, and lying between the main stream and the river Içа. Each of them evidently takes the place of the others in its particular district. Of this peculiar

kind of distribution few instances are known amongst mammals, but many somewhat similar cases have been observed in birds, reptiles, and butterflies.

The fourth and lowest sub-family of the Cebidæ (Nyctipithecinæ) includes three genera—the Douroucoulis (*Nyctipithecus*), the Titis (*Callithrix*), and the Squirrel-Monkeys (*Chrysothrix*), and numbers altogether some twenty species. This group, as a whole, has a wide range like the two first sub-families, extending from Central America to Paraguay. But the species are most abundant in the centre of the area, where some of them, so far as is yet known, have a very limited range.

Section V.—Distribution of the Marmosets

Like the Platyrrhine Monkeys the little Marmosets, which constitute the family *Hapalidæ*, are entirely restricted to the tropical forests of the New World. The family embraces but two genera generally acknowledged—*Hapale* with about seven, and *Midas* with about fourteen or fifteen species. But these small creatures are still little known, and it is probable that many more of them remain to be discovered when the vast forest-region through which they are distributed shall have been more thoroughly explored. The Marmosets do not extend so far north as the true Monkeys, only a single species (*Midas geoffroyi*) having yet been ascertained to range north of the Isthmus of Panama as far as Chiriqui. Thence, southwards, they are thinly distributed over the South American continent down to the northern provinces of the Argentine Republic, where *Hapale penicillata* is said to occur in the forests of Salta

and Jujuy. The Marmosets appear to be most numerous in the forests of Amazonia, where some of them are confined to very restricted districts. Our best account of these animals is to be found in the journals of the excellent observer Bates.

Section VI.—Summary and Deductions

The subjoined table contains a list of the genera of the Order Quadrumana, or Monkeys, and gives the approximate number of species met with in each of the great geographical Regions.

	Total No. of Species.	I. Australian.	II. Neotropical.	III. Ethiopian.	IIIa. Malagasy.	IV. Oriental.	V. Nearctic.	VI. Palæarctic.
Family I. SIMIIDÆ.								
1. Anthropopithecus . .	3	...	...	3	...	...	...	...
2. Simia	1	...	...	...	...	1	...	...
3. Hylobates	7	...	...	...	...	7	...	...
	11	...	...	3	...	8	...	...
Family II. CERCOPITHECIDÆ.								
1. Nasalis	1	...	...	...	...	1	...	...
2. Semnopithecus . . .	29	...	...	...	...	28	...	1
3. Colobus	10	...	...	10	...	...	...	...
4. Cercopithecus	40	...	...	40	...	...	...	...
5. Cercocebus	6	...	...	6	...	...	...	...
6. Macacus	17	...	...	...	...	13	...	4
7. Cynopithecus	1	...	...	...	...	1	...	...
8. Theropithecus . . .	2	...	...	2	...	...	...	...
9. Cynocephalus	11	...	...	11	...	...	...	...
	117	...	...	69	...	43	...	5

Summary and Deductions (*continued*).

	Total No. of Species.	I. Australian.	II. Neotropical.	III. Ethiopian.	IIIa. Malagasy.	IV. Oriental.	V. Nearctic.	VI. Palæarctic.
Family III. CEBIDÆ.								
10. Ateles	10	...	10	...	...	...	...	...
11. Brachyteles	1	...	1	...	...	...	...	...
12. Cebus	18	...	18	...	...	...	...	...
13. Mycetes	6	...	6	...	...	...	...	...
14. Pithecia	5	...	5	...	...	...	...	...
15. Brachyurus	3	...	3	...	...	...	...	...
16. Nyctipithecus	5	...	5	...	...	...	...	...
17. Callithrix	11	...	11	...	...	...	...	...
18. Chrysothrix	4	...	4	...	...	...	...	...
	63	...	63	...	...	...	...	...
Family IV. HAPALIDÆ.								
19. Midas	14	...	14	...	...	...	...	...
20. Hapale	7	...	7	...	...	...	...	...
	21	...	21	...	...	...	...	...

Summary.

Families.	Total.	I. Australian.	II. Neotropical.	III. Ethiopian.	IIIa. Malagasy.	IV. Oriental.	V. Nearctic.	VI. Palæarctic.
I. Simiidæ	11	...	...	3	...	8	...	...
II. Cercopithecidæ	117	...	...	69	...	43	...	5
III. Cebidæ	63	...	63	...	...	...	...	...
IV. Hapalidæ	21	...	21	...	...	...	...	...
	212	...	84	72	...	51	...	5

Deductions.

1. The Order Quadrumana, or Monkeys, contains about 212 species, divisible into twenty genera and four families.

2. Monkeys are found only in the tropical and sub-tropical portions of the Eastern and Western Hemispheres, and are absent in Australia and Madagascar.

3. The Monkeys of the Eastern and Western Hemispheres are quite distinct in structure, and belong to different families.

4. In the Western Hemisphere Monkeys are restricted to the Neotropical Region, not occurring north of 20° N. lat., or south of 30° S. lat.

5. In the Eastern Hemisphere some few species of Monkeys are met with as far north as 40° N. lat., and in Africa descend to 35° S. lat.

6. The Monkeys of the Ethiopian and Oriental Regions belong to distinct genera.

7. The Anthropoid Apes are restricted to the tropics of Africa and Asia, the most highly organized of them being the Chimpanzees of Africa and the Orangs of Asia.

Section VII.—Distribution of the Lemurs

The Lemurs, which by many recent authorities are united with the Monkeys to form the Order Primates, but which it is, in some respects, more natural to retain as an Order by themselves, number altogether some fifty species—only one-fourth of the number of the Quadrumana. They are also very different in geographical distribution, thirty-five out of the whole series being confined to the Malagasy Sub-region, whilst the few remaining forms are met with only in isolated portions of the Ethiopian and Oriental Regions. Besides the family of

true Lemurs (*Lemuridæ*) this Order contains the two aberrant types, the Tarsier (*Tarsius*) and Aye-aye (*Chiromys*), both of them of family value. We will say the few words that are necessary about the distribution of each of these three families.

The typical Lemurs (*Lemuridæ*), are usually divided into four sub-families, the *Indrisinæ* (Indrises), *Lemurinæ* (Lemurs), *Galaginæ* (Galagos), and *Lorisinæ* (Slow Lemurs). Of these, as will be seen by the annexed table, the two first sub-families, which contain seven genera and about twenty-four species, are absolutely confined to Madagascar and its adjoining islets. It is, in fact, mainly the presence of these peculiar animals, which constitute altogether nearly one half of the whole mammal-fauna of Madagascar, that renders the Malagasy fauna so very different from that of any other part of the world's surface, and makes it a moot point as to whether this zoological division should not be more properly treated as a "Region," than as a "Sub-region." When we come to the third sub-family—the Galagos—we find the typical genus *Galago* with its six species distributed over continental Africa, but the three other genera of this family, which contains smaller animals of somewhat aberrant form, are again entirely restricted to Madagascar. The fourth and most aberrant group of the Lemurs, commonly called Slow Lemurs, from their nocturnal habits and sleepy dispositions, contains four genera, two of which belong to the Ethiopian Region and two to the Oriental Region. Although they vary considerably in structure from the more typical Lemurs, there can be no doubt that the Slow Lemurs possess a true Lemurine structure in many important particulars, so that they must have had a common origin with the true Lemurs. This fact would seem to show that the ancient "Lemuria," as the hypothetical

continent which was originally the home of the Lemurs has been termed, must have extended across the Indian Ocean and the Indian Peninsula to the further side of the Bay of Bengal and over the great islands of the Indian Archipelago.

Section VIII.—Summary and Deductions

Table of the genera of Lemurs and of the number of species found in each Zoological Region.

	Total.	I. Australian.	II. Neotropical.	III. Ethiopian.	IIIa. Malagasy.	IV. Oriental.	V Nearctic.	VI. Palæarctic.
Family I.								
LEMURIDÆ.								
Sub-family I.—Indrisinæ.								
1. Indris	1	...	...	...	1	...	...	...
2. Propithecus	4	...	...	...	4	...	...	...
3. Avahis	1	...	...	...	1	...	...	...
Sub-family II.—Lemurinæ.								
4. Lemur	8	...	...	...	8	...	...	...
5. Mixocebus	1	...	...	...	1	...	...	...
6. Hapalemur	2	...	...	...	2	...	...	...
7. Lepidolemur	7	...	...	...	7	...	...	...
Sub-family III.—Galaginæ.								
8. Galago	6	...	...	6	...	...	...	...
9. Chirogale	4	...	...	...	4	...	...	...
10. Microcebus	5	...	...	...	5	...	...	...
11. Otolemur	2	...	...	...	2	...	...	...
Sub-family IV.—Lorisinæ.								
12. Loris	1	...	...	...	...	1	...	...
13. Nycticebus	1	...	...	...	...	1	...	...
14. Perodicticus	1	...	...	1	...	...	...	...
15. Arctocebus	1	...	...	1	...	...	...	...
	45	...	...	8	35	2	...	...

SUMMARY AND DEDUCTIONS (*continued*).

	Total.	I. Australian.	II. Neotropical.	III. Ethiopian.	IIIa. Malagasy.	IV. Oriental.	V. Nearctic.	VI. Palæarctic.
FAMILY II. TARSIIDÆ.								
1. Tarsius	2	...	...	...	...	2	...	...
FAMILY III. CHIROMYIDÆ.								
1. Chiromys	1	...	...	...	1	...	...	...
	48	...	...	8	36	4	...	...

DEDUCTIONS

1. About forty-eight species of the Order Lemures, belonging to seventeen genera and three families, are known.

2. Of these thirty-six species, representing twelve genera, are restricted to the Malagasy Sub-region, which must be regarded as the special home of the Lemurine Mammals.

3. The remaining forms of Lemurs are thinly spread over the Ethiopian and Oriental Regions, Lemurs being altogether absent in the Palæarctic, Australian, Nearctic, and Neotropical Regions.

4. The Aye-aye (*Chiromys*), forming a family of itself, is restricted to Madagascar.

CHAPTER X

DISTRIBUTION OF THE ORDER CARNIVORA

Section I.—Introductory Remarks

The true Carnivora are widely distributed over the world, and occur, in fact, everywhere from north to south, with the exception of the Australian Region, where their functions in nature are performed by the flesh-eating Marsupials. The Polar Bear probably ranges farther north than any other species of mammal, while the southernmost point of the South American Continent is inhabited by the Magellanic Dog. In the Antarctic Seas the Carnivora are also represented by several species of Seals, but no land-mammal has yet been found on the Antarctic Continent.

The Carnivora are very numerous, nearly 300 species belonging to seventy genera being usually recognized. They are usually divided by modern authorities into four well-marked sections: (1) the Æluroid, or Cat-like Carnivores, belonging to four families; (2) the Cynoid, or Dog-like Carnivores, consisting of the single family *Canidæ*; (3) the Arctoid, or Bear-like Carnivores, with three families; and finally, the Pinnipeds, or Marine Carnivora, with three families. We will take these in order, pointing out the most noticeable features in the distribution of the principal and best-known forms in each

family, and only alluding to the less-known and more insignificant forms when remarkable for their special distribution or otherwise.

Section II.—Distribution of the Cat-like Carnivora

The Æluroid, or Cat-like Carnivora, among which will be found the largest and most perfectly organized terrestrial animals in the present condition of the world, that have been modified to prey upon their weaker brethren, embrace four families, the Cats, Civets, Aard-Wolf, and Hyenas. The first family, the *Felidæ*, or Cats, contains about fifty species of true *Felis*, together with the Cheetah, or Hunting-Leopard, which it is necessary to refer to a separate genus. The Cats are distributed all over the main portions of both the Old and New Worlds, failing, however, as already remarked, in the Australian Region, and not extending quite so far north nor quite so far south as the Bears and Dogs. No single Cat, however, has anything like this wide area of distribution, all the species being more or less limited in their extension, and the Cats of the Old and New Worlds being always specifically different, unless it be in the case of the Northern Lynxes. We will shortly describe the specific areas of some of the best-known of these animals.

The Lion, the undoubted king of beasts, though it formerly penetrated far into Europe and even into England, is in these days essentially an African animal, but still extends throughout Arabia, Asiatic Turkey, and Persia into Western India, where it occurs in the Western Provinces.

Though the Lion varies greatly in shape and colour, and in other minor features in different districts, it seems impossible to accept the proposed division of it by some authors into species, or even into geographical sub-species. It is true that an expert, well accustomed to examine Lions, will usually be able to guess correctly the locality whence any particular specimen has been received, but this is by no means absolutely certain.

The Tiger, the next noblest beast of prey existing in the present day, and by some writers assigned to a station superior even to that of the Lion, is essentially, no doubt, an inhabitant of the Oriental Region, but has extended its range in many places, probably within a not very distant period, far to the north. The Indian Peninsula may be said to be its focus, where it is found almost everywhere from the Himalayas, which it ascends to a height of 6000 or 7000 feet, to Cape Comorin. Curiously enough, however, the Tiger is not found in Ceylon. Outside India the Tiger ranges throughout Northern Persia, Turkestan, and the southern provinces of China, reaching on the west up to Manchuria and Amurland, where, however, it has learnt to put on a thicker and longer coat in winter to protect it from the severe cold. To the south and east of India the Tiger extends all over the Siamese and Malay Peninsulas into Sumatra and Java, but not, it is believed, into Borneo. Tigers from Sumatra and Java do not, however, attain to the large dimensions of their brethren of India and the north.

The third great Cat of the Old World, the Leopard, has a still wider distribution than its two larger brethren. Not only does it inhabit the whole of Africa, including its northern portion, but extends also nearly over every part

of the Oriental Region and into the confines of the Palæarctic. The Leopard is met with throughout Western Asia, Persia, the Indian Peninsula, including Ceylon, the Siamese and Malay Peninsulas, China, and the larger islands in the Indian Archipelago. It varies much throughout its range, not only in size, but in shape and in the character of its markings; yet it is impossible to consider more than one species of Leopard as satisfactorily established.

The fourth great Cat of the Old World, the Ounce (*Felis uncia*), distinguished at once from the Leopard by its white body-colour, thick fur, and much lengthened tail, is confined to the high ranges of Central Asia, and occurs only at elevations of over 8000 feet. In Gilgit, Hunza, and Tibet, it occurs occasionally within the range of the Indian sportsman, but is more frequent further north, and in the north-west ranges of Siberia and Amurland.

After the four great Cats of the Old World, we must proceed to discuss the corresponding animals of the New World. These are two only in number, the Jaguar (*F. onca*), and the Puma (*F. concolor*), both inferior in size and organization to the Lion and Tiger, the places of which they are generally supposed to take in the Western Hemisphere. The Puma has a very wide distribution in America, extending over the greater part of both North and South America, from the most northern of the United States and British Columbia down to Patagonia. In the extent of its range from north to south, the Puma seems to surpass every other carnivorous animal.

The Jaguar has likewise a very wide distribution in America, though it cannot rival the Puma in this respect. Its northern limit in these days appears to be Louisiana,

Texas, and the adjoining southern United States. Hence it ranges throughout Central and South America down to the Rio Negro of Patagonia. As might, however, have been expected from its being essentially a forest-loving animal, the Jaguar does not occur on the western side of the Andes south of Ecuador.

Thus we may take it that of the six largest and finest carnivorous mammals of the existing creation, four are found in the Old Continent and two others, generally inferior in structure, in the New World. We need not here go at length into the distribution of the smaller cats, some forty or forty-five in number, as variously estimated. It is sufficient to say that those of the New World are specifically distinct from those of the Old, except in the case of the Lynxes, in which the differentiation of the Canada Lynx (*F. canadensis*) from *F. lynx* of the Palæarctic Region is perhaps somewhat doubtful. The cats of the Ethiopian and Oriental Regions are also, as a rule, different, and many of them are restricted to comparatively narrow geographical limits.

The second genus of the Cat family (*Felidæ*) contains only the Hunting Leopard, *Cynælurus jubatus*, which has somewhat the same distribution as the Lion. It is found all over Africa, and extends throughout South-western Asia and Persia into Western India up to the confines of Bengal. Attention, however, should be directed to a supposed second species of this genus, the Woolly Cheetah (*C. laniger*), which has hitherto been only met with in some of the higher districts of the Cape Colony.

Next to the Cats we come to the *Viverridæ*, or Civets, a much more numerous group containing about seventy species, usually divided into about twenty-four genera.

In the New World the *Viverridæ* are entirely unrepresented, and, as a rule, may be said to belong to the tropical portions of the Ethiopian and Oriental Regions, being entirely absent in the Australian Region. It may also be again remarked that the Malagasy Sub-region is quite peculiar as regards its *Viverridæ*, six well-marked genera of this family being entirely restricted to that anomalous island, whilst the seventh, *Viverricula*, is probably only an introduction from the Oriental Region.

In the Palæarctic Region the *Viverridæ* are feebly represented by a few scattered species which have strayed from the south into its limits, such as the Common Genet (*Genetta vulgaris*) and the Ichneumon (*Herpestes ichneumon*), which are both met with in Southern Spain and Algeria. As a rule, again it may be said that the Ethiopian and Oriental *Viverridæ* are not only specifically but generically different. But one large genus, *Herpestes*, has its twenty species divided pretty equally between the two Regions, and the typical Civets, *Viverra*, are found both in Africa and India.

A third family of the Æluroid Carnivora has been necessarily formed for the reception of the Aard-Wolf (*Proteles cristatus*). This is a hyenoid form well distinguished by its extremely peculiar dentition. The Aard-Wolf appears to be restricted to the southern and eastern portions of Africa, and constitutes one of the most characteristic forms of Ethiopian mammal-life.

Finally, closing the Æluroid series, we have the small family of Hyænas (*Hyænidæ*) containing three well-marked species, which, taken on the whole, must be denominated Ethiopian, as they all three occur within

the limits of that Region, and two of them at the present epoch are restricted to it. But the Striped Hyæna (*Hyæna striata*) extends from North-east Africa through Arabia and Persia into Northern India, where it is common in the North-western and Central Provinces. It must therefore be registered as a common inhabitant of the Ethiopian and Oriental Regions.

Section III.—Distribution of the Dog-like Carnivora

The Cynoid, or Dog-like Carnivora, consists only of the single family *Canidæ*. Of this the great mass of species (from thirty to forty in number) belongs to the true Dogs (*Canis*), which, as we shall see, are very widely distributed over the earth's surface, whilst the three remaining genera are isolated forms, each of one species only, and are restricted to narrow geographical limits.

The Dogs (*Canis*) are amongst the most hardy of known mammals, and are spread, as already stated, over the whole earth, being apparently adaptable to all the zones, whether tropical, temperate, or frigid. The anomalous island of Madagascar is the only land to which they have not penetrated, that is, if we allow the Dingo of Australia to be an indigenous and not an introduced species, which is a point open to question. In the Arctic Regions the Polar Fox (*Canis lagopus*) extends as far north as any other carnivorous mammal, except perhaps the Polar Bear, and is found far above the Arctic Circle in both the Old and the New World alike. On the other hand, in the extreme south of the New

World we find the Magellanic Dog (*Canis magellanicus*), which extends to the very farthest extremity of the American continent, while in Southern Africa the Black-backed Jackal (*C. mesomelas*) is met with in the vicinity of Cape Town, and in Australia the Dingo, now only known in a semi-domestic state, is found over the whole continent. But although, as we have shown, the genus *Canis* is so widely spread over all parts of the earth, the individual species are in some cases confined to restricted areas. Many well-known members of the genus—such as the Wolf, the Common Fox, and the Jackal—have a very wide distribution. But other species of Dog have limited ranges, and not more than two or three of them are usually met with in exactly the same district. Examples of this restricted distribution are afforded by the Maned Wolf (*Canis jubata*) of Brazil and Argentina, by the Corsac (*Canis corsac*) of Central Asia, and by several of the African Fennecs. But as a rule it may be taken that the various species of Dogs are hardy animals with extended areas of distribution.

Besides the genus *Canis*, the Dog family contains three other well-marked genera, each embracing but one species. One of these, the Bush-dog (*Icticyon venaticus*), is found only in Brazil and British Guiana, the two others, the Hunting-dog (*Lycaon pictus*) and the Long-eared Fox (*Otocyon megalotis*) are both peculiar to the Ethiopian Region, where the *Lycaon* appears to have a considerable range from north to south, but *Otocyon* is only known from the Cape Colony.

Section IV.—Distribution of the Bear-like Carnivora

We now come to the third and last division of the terrestrial Carnivora, which consists of those allied to the Bears and therefore denominated Arctoid. This division embraces three families—the *Ursidæ*, or Bears, which have a fairly wide distribution in both Hemispheres, the *Procyonidæ*, or Raccoons, which, with a single exception, are confined to the New World, and the *Mustelidæ*, or Weasels, which belong mostly to the Old World with a comparatively few representatives in the New World.

The Bears (*Ursidæ*), which head the group, contain, after the Cats, the largest and most destructive of the carnivorous animals of the present day. There has been a tendency of late days, unnecessarily, as we think, to augment the specific forms of the true Bears (*Ursus*). The species, recognizable by obvious external characters, do not appear to exceed ten in number. Taken as a whole the genus *Ursus* presents some very interesting features in its distribution. Its generic area embraces the whole of the Palæarctic and Nearctic Regions and extends into the northern confines of the Oriental. In the Ethiopian Region *Ursus* is entirely absent, and constitutes an important lipomorph. In the Neotropical Region it is represented by a single species, the Spectacled Bear (*U. ornatus*) of the Andes. In the extreme north of the globe the Polar Bear (*U. maritimus*) ranges round the Arctic Circle. The next northern species met with is the

Brown Bear (*U. arctos*), which, under different forms and varieties, occupies the whole Palæarctic Region, and is represented in the Nearctic by the scarcely distinct Grizzly Bear (*U. horibilis*) under various forms. A third species is the Black Bear of North America (*U. americanus*) which is represented in Japan by *U. japonicus* and throughout Central Asia by the Himalayan Bear (*U. tibetanus*). Finally, in the Oriental Region we meet with the Malayan Bear (*U. malayanus*), which is found not only in the Malay Peninsula but extends on one side into the islands of Sumatra, Java, and Borneo, and on the other side through Burma into North-eastern India. It is a curious fact that the Malayan Bear is entirely frugivorous, while its huge ally the Polar Bear, with exactly the same dentition, in all probability eats little else than flesh.

Besides the true Bear (*Ursus*), two other genera, each containing but a single species, must be placed in the same family. These are the Sloth Bear (*Melursus*) of India, which is restricted to the Indian Peninsula and Ceylon, and must be therefore regarded as a purely Oriental type, and the Æluropus (*Æluropus melanoleucus*), which occurs only in the high mountains of Eastern Tibet and must be attributed to the Palæarctic Region.

As already stated the *Procyonidæ*, or Raccoons, which embrace six genera and about nine species, are inhabitants of the New World with one singular exception. This is the peculiar Panda (*Ælurus fulgens*) of Nepaul, which, although at one time believed to belong to the Bear family, is now usually held to be most nearly related to the Raccoons of America. With this one exception the Raccoons

are found only in the New World and mainly in the Neotropical Region, though as many as four species come within the limits of the Nearctic Region. The true Raccoons (*Procyon*) have a representative in each of the two Regions, while the Coatis (*Nasua*) and the Kinkajou (*Cercoleptes*) just come within the boundaries of the Nearctic Region from the south, and *Bassariscus* is restricted to Central America.

In the last family of terrestrial Carnivora belonging to the Arctoid division, we find a much more numerous group, the *Mustelidæ*, or Weasels, embracing about seventeen genera, represented by upwards of eighty different species. On the whole it may be said that the *Mustelidæ* are most abundant in the Nearctic, Palæarctic, and Oriental Regions, and less well represented in the Ethiopian and Neotropical Regions, while, like the rest of the Carnivores, except *Canis*, they are wholly absent in Australia. The eleven known Neotropical *Mustelidæ* belong to five genera, three of which are peculiar to this Region, while the two others, the Otters (*Lutra*) and the Weasels (*Mustela*), are both wide-ranging forms met with also in the Nearctic Region and broadly diffused in the Old World. It may be remarked, however, that Weasels (*Mustela*) do not occur in the Ethiopian Region, where, however, the Otters (*Lutra*) are represented by two species. The Nearctic Region is tenanted by several well-marked forms of the Musteline group, amongst which we may specify the Sea Otter (*Latax*), the Skunks (*Mephitis* and *Spilogale*), and the Glutton (*Gulo*); the last-mentioned type, however, being likewise found in the Palæarctic Region.

Section V.—Distribution of the Marine Carnivora

The Marine Carnivora, or Pinnipeds, which close the series of mammals of this order, are, as has already been shown, distributed on quite a different system from that which prevails in the terrestrial groups of mammals. As, however, they resort more or less to land for breeding purposes, the laws which regulate their distribution are more like those of terrestrial mammals than those which guide the distribution of such purely oceanic forms as the Cetaceans. We have already discussed the main facts of the distribution of the Pinnipeds in a former chapter of this work (Chapter VIII. sect. 2), and it is not now necessary to repeat them, further than to point out that of the three families comprised in this group the *Otariidæ*, or Sea-lions, are essentially Antarctic, only passing to the north in the Pacific where three species occur. On the other hand the Walruses (*Trichechus*), which are the sole constituents of the second family *Trichechidæ*, are still more absolutely Arctic, being only found in the North Atlantic and the North Pacific. The third family of Pinnipeds, of which about nine generic forms are recognized, are, on the other hand, much more widely diffused, though most prevalent in high and low latitudes and but feebly represented within the tropics. It should be also specially noted that the five known genera of Antarctic *Phocidæ* are quite different from those of the Arctic seas, although one of them (*Macrorhinus*) has wandered far up the coast of Western America to the shores of Southern California.

Section VI.—Summary and Deductions

Table of the genera of Carnivora, and of the approximate number of species met with in the principal Zoological Regions.

A. Terrestrial Carnivora

	Total Species.	I. Australian.	II. Neotropical.	III. Ethiopian.	IIIa. Malagasy.	IV. Oriental.	V. Nearctic.	VI. Palearctic.
Family I. FELIDÆ.								
1. Felis	50	...	13	8	...	15	7	20
2. Cynælurus	1	...	...	1	...	1	...	1
Family II. VIVERRIDÆ.	51	...	13	9	...	16	7	21
3. Cryptoprocta	1	...	...	...	1	...	...	...
4. Viverra	3	...	...	1	...	2	...	...
5. Viverricula	1	...	...	...	1	1	...	...
6. Fossa	1	...	...	...	1	...	...	...
7. Genetta	4	...	...	4	...	...	...	1
8. Prionodon	3	...	...	...	...	3	...	...
9. Poiana	1	...	...	1	...	...	...	...
10. Paradoxurus	10	...	...	...	...	10	...	...
11. Arctogale	2	...	...	...	...	2	...	...
12. Hemigale	2	...	...	...	...	2	...	...
13. Arctictis	1	...	...	...	...	1	...	...
14. Nandinia	2	...	...	2	...	...	...	...
15. Cynogale	1	...	...	...	...	1	...	...
16. Herpestes	19	...	...	10	...	9	...	1
17. Helogale	1	...	...	1	...	...	...	...
18. Bdeogale	2	...	...	2	...	...	...	...
19. Cynictis	2	...	...	2	...	...	...	...
20. Rhinogale	1	...	...	1	...	...	...	...
21. Crossarchus	5	...	...	5	...	...	...	...
22. Suricata	1	...	...	1	...	...	...	...
23. Galidictis	2	...	...	...	2	...	...	...
24. Galidea	1	...	...	...	1	...	...	...
25. Hemigalidea	2	...	...	...	2	...	...	...
26. Eupleres	1	...	...	...	1	...	...	...
	69	...	...	30	9	31	...	2

A. TERRESTRIAL CARNIVORA (*continued*).

	Total Species.	I. Australian.	II. Neotropical.	III. Ethiopian.	IIIa. Malagasy.	IV. Oriental.	V. Nearctic.	VI. Palæarctic.
FAMILY III. PROTELEIDÆ.								
27. Proteles	1	...	...	1	...	...	...	...
FAMILY IV. HYÆNIDÆ.								
28. Hyæna	3	...	...	3	...	1	...	1
FAMILY V. CANIDÆ.								
29. Canis	35	1	9	7	...	3	9	13
30. Lycaon	1	...	...	1	...	...	...	...
31. Otocyon	1	...	...	1	...	...	...	...
32. Icticyon	1	...	1	...	...	...	...	...
	38	1	10	9	...	3	9	13
FAMILY VI. URSIDÆ.								
33. Ursus	10	...	1	...	...	2	4	5
34. Melursus	1	...	...	...	...	1	...	...
35. Æluropus	1	...	...	...	...	...	...	1
	12	...	1	...	...	3	4	6
FAMILY VII. PROCYONIDÆ.								
36. Ælurus	1	...	...	...	...	1	...	...
37. Procyon	2	...	1	...	...	...	1	...
38. Bassariscus	1	...	...	...	...	...	1	...
39. Bassaricyon	2	...	2	...	...	...	...	...
40. Nasua	2	...	2	...	...	...	1	...
41. Cercoleptes	1	...	1	...	...	...	1	...
	9	...	9	...	...	1	4	...

A. Terrestrial Carnivora (*continued*).

	Total Species.	I. Australian.	II. Neotropical.	III. Ethiopian.	IIIa. Malagasy.	IV. Oriental.	V. Nearctic.	VI. Palæarctic.
Family VIII. MUSTELIDÆ.								
42. Lutra	11	...	3	2	...	3	2	1
43. Latax	1	...	...	...	...	...	1	...
44. Mephitis	5	...	...	...	...	...	5	...
45. Conepatus	4	...	3	...	...	...	1	...
46. Arctonyx	3	...	...	...	...	1	...	3
47. Mydaus	2	...	...	...	...	2	...	...
48. Meles	4	...	...	...	...	...	...	4
49. Taxidea	2	...	...	...	...	...	2	...
50. Mellivora	2	...	...	1	...	1	...	...
51. Helictis	5	...	...	...	...	5	...	...
52. Ictonyx	4	...	...	3	...	...	...	2
53. Galictis	2	...	2	...	...	...	...	...
54. Mustela	30	...	2	...	...	4	10	15
55. Pœcilogale	1	...	...	1	...	...	...	...
56. Lyncodon	1	...	1	...	...	...	...	...
57. Gulo	1	...	...	...	...	...	1	1
58. Spilogale	2	...	...	...	...	...	2	...
	80	...	11	7	...	16	24	26

B. Marine Carnivora

	Total Species.	I. Arctalantis.	II. Mesatlantis.	III. Indopelagia.	IV. Arctirenia.	V. Mesirenia.	VI. Notopelagia.
Family IX. OTARIIDÆ.							
59. Otaria	9	...	...	...	3	2	9
Family X. TRICHECHIDÆ.							
60. Trichechus	2	1	...	...	1	...	...
Family XI. PHOCIDÆ.							
61. Phoca	6	5	...	...	4	...	...
62. Halichœrus	1	...	...	...	...	...	...
63. Monachus	1	...	2	...	...	...	...
64. Cystophora	1	1	...	...	...	...	...
65. Macrorhinus	2	...	...	...	...	1	1
66. Ogmorhinus	1	...	...	...	...	...	1
67. Lobodon	1	...	...	...	...	...	1
68. Leptonychotes	1	...	...	...	...	...	1
69. Ommatophoca	1	...	...	...	...	...	1
	15	6	2	...	4	1	5

Deductions

1. About 260 species of terrestrial Carnivora are known, divisible into fifty-eight genera and eight families.

2. They are distributed pretty equably over all the Regions of the earth except Australia, where the Dingo (possibly introduced) is their only representative.

3. The only Carnivores in Madagascar are Civets (*Viverridæ*), and out of the seven genera of that family represented there six are peculiar.

4. There are no Bears (*Ursidæ*) in the Ethiopian Region.

5. The Raccoons (*Procyonidæ*), with a single exception, are peculiar to the New World, where they may perhaps replace the Civets (*Viverridæ*), which are confined to the Old World.

6. The Marine Carnivora consist of three families which are divided into eleven genera and about twenty-six species.

7. The Walruses are characteristic of the Arctic Seas and the Sea-lions of the Antarctic, but in the Pacific the Sea-lions are also found in the North.

8. The Seals (*Phocidæ*) are both Arctic and Antarctic, but are represented by quite different genera in these two areas.

CHAPTER XI

DISTRIBUTION OF INSECTIVORES, BATS, AND RODENTS

SECTION I.—INTRODUCTORY REMARKS

THE three Orders, to which it is proposed to devote the present chapter, contain the most difficult and least known members of the whole class. They are very numerous, especially the two latter groups, nearly all of small size, and in most parts of the world have been very imperfectly studied. Within these last few years large additions have been made to our knowledge of them, especially in the case of the Rodents, and their proper systematic arrangement is still a matter of much discussion amongst naturalists. Under these circumstances, and looking to the fact that these small mammals are of much less general interest than their larger brethren, it is not proposed to go very fully into the subject of their geographical distribution, but merely to point out some of the leading and less controvertible facts known upon this part of their history. We will commence with the Insectivores, which are generally allowed to be in many respects allied to the Carnivores, although they present certain points in their structure which appear to show a probability of their original descent from much lower forms.

Section II.—Distribution of Insectivores

The Insectivores are for the most part widely scattered over the earth's surface, but not very numerous in species except in certain localities. In the Australian Region they are entirely absent, their place in nature being there taken by the Insectivorous Marsupials, and in the Neotropical Region, they have only penetrated as far south as certain districts in the Northern Andes. In this case also we may suppose that their functions are performed by the smaller Opossums (*Didelphyidæ*), which subsist almost entirely upon insects. In almost every other part of the earth, as we shall see, the Insectivores are represented either by special types or by members of the widely-spread group of Shrews.

As will be seen by the tables given below (p. 260) the Insectivores, according to a moderate estimate, are supposed to number about 230 species, divisible into forty-one genera. These genera are grouped in ten families, on the distribution of each of which a few words may be said.

At the head of the Order it is best to place the Kaguan, or Flying Lemur as it is commonly called, though its structure is so peculiar and its affinities so little obvious that it might perhaps be more properly ranked in an Order by itself. Of this family only a single genus (*Galeopithecus*) with two species is known, one found in the Malay Peninsula and the islands of the Eastern Archipelago, and a second, smaller form in the Philippine group. The *Galeopithecidæ*, therefore, may be placed as a characteristic form of the Oriental Region.

The second family of Insectivora, the *Tupaiidæ*, or

Tree-shrews, with two genera and about fifteen species, is likewise confined to the Oriental Region, and forms another characteristic group of that Region.

In the third family of Insectivorous Mammals the *Macroscelidæ*, or Jumping Shrews, which, though held to represent the Tree-shrews in Africa, are very different in appearance and are essentially terrestrial in their habits, must be considered as a purely Ethiopian type, though one form (*Macroscelides rozeti*) has crossed the limits of the Ethiopian Region into Algeria.

The fourth family of Insectivora, the *Erinaceidæ*, or Hedgehogs, are rather more widely diffused. The true Hedgehogs (*Erinaceus*), of which about fourteen species are known, are spread all over the Ethiopian Region except Madagascar, and are likewise found in the Oriental and Palæarctic Regions. The second genus of *Erinaceidæ* (*Gymnura*), of which two species are distinguished, is restricted to the Oriental Region.

In the fifth sub-family of this Order the *Soricidæ*, or Shrews, we find the most numerous and the most widely extended mammals of this group. Though these little animals are still very imperfectly known and many more species must remain to be discovered, they already number some 125 species. These are spread over nearly the whole earth except the Australian Region and the Neotropical Region, where, however, in the northern borders two or three species are known to occur. The Musk-shrews (*Crocidura*) are the most numerous of all the genera, more than eighty species of these little animals having been already described. They are found in Africa and Madagascar and are also numerous in the Oriental and Palæarctic Regions, but do not occur at all in the New World.

Others of the eleven genera of this family, however, are based on one or two species and have a much more limited distribution, such as the Water-shrew (*Crossopus*) of Europe and Northern Asia, and *Nectogale*, the Web-footed Shrew of Tibet.

After the Shrews follow the Moles (*Talpidæ*) of which about eleven genera are known containing altogether about twenty-three species. The Moles are specially characteristic of the Palæarctic and Nearctic Regions, to which nearly all the genera and species are confined, but one or two species of true Moles (*Talpa*) have invaded the confines of the Oriental Region.

The seventh family of Insectivores (*Potamogalidæ*) contains only two isolated forms—*Potamogale* from West Africa and *Geogale* from Madagascar. This group must therefore be attributed to the Ethiopian Region.

Allied to the last-named family, but still more closely to the Tenrecs which follow them, are the two species of the remarkable genus *Solenodon*, to find which we must go, strangely enough, as far as the West Indian Islands. Here linger the last representatives of this singular group of Insectivores, one species, *Solenodon paradoxus*, being restricted to Hayti and the other, *S. cubanus*, to Cuba.

The Tenrecs (*Centetidæ*), which form the ninth family of Insectivorous Mammals, number as many as twenty-one species which belong to seven genera, of which the distribution may be very shortly described, as they all belong to the island of Madagascar, and constitute one of the most curious of the primitive forms of animal life that render the Malagasy Sub-region so remarkable.

Finally, closing the Order of Insectivores, we find the

Golden Moles (*Chrysochloridæ*), a family containing but one genus, *Chrysochloris*, with seven species all confined to the Ethiopian Region.

Summary and Deductions as regards the Insectivores

Table of the families and genera of the Order Insectivora, showing the approximate number of species in each of the Regions.

	Total Species.	I. Australian Region.	II. Neotropical Region.	III. Ethiopian Region.	IIIa. Malagasy Region.	IV. Oriental Region.	V. Nearctic Region.	VI. Palæarctic Region.
FAMILY I. GALEOPITHECIDÆ.								
1. Galeopithecus	2	...	...	...	...	2	...	...
FAMILY II. TUPAIIDÆ.								
2. Tupaia	14	...	...	...	...	14	...	...
3. Ptilocercus	1	...	...	...	...	1	...	...
	15	...	...	...	...	15	...	...
FAMILY III. MACROSCELIDIDÆ.								
4. Macroscelides	10	...	...	10	...	...	...	...
5. Petrodromus	3	...	...	3	...	...	...	...
6. Rhynchocyon	4	...	...	4	...	...	...	...
	17	...	...	17	...	...	...	...
FAMILY IV. ERINACEIDÆ.								
7. Gymnura	2	...	...	...	...	2	...	...
8. Erinaceus	14	...	...	4	...	4	...	6
	16	...	...	4	...	6	...	6

Summary and Deductions as regards the Insectivores (continued).

	Total Species.	I. Australian Region.	II. Neotropical Region.	III. Ethiopian Region.	IIIa. Malagasy Region.	IV. Oriental Region.	V. Nearctic Region.	VI. Palæarctic Region.
FAMILY V. SORICIDÆ.								
9. Sorex	18	...	...	...	...	...	12	6
10. Soriculus	4	...	...	...	...	4	...	...
11. Blarina	8	...	2	...	...	...	6	...
12. Notosorex	2	...	...	...	...	...	2	...
13. Crossopus	1	...	...	...	...	...	...	1
14. Myosorex	4	...	...	4	...	...	...	...
15. Crocidura	82	...	...	40	2	30	...	10
16. Diplomesodon	1	...	...	...	...	...	...	1
17. Anurosorex	2	...	...	...	...	1	...	1
18. Chimarrhogale	2	...	...	...	...	1	...	2
19. Nectogale	1	...	...	...	...	...	...	1
	125	...	2	44	2	36	20	22
FAMILY VI. TALPIDÆ.								
20. Myogale	2	...	...	...	...	...	...	2
21. Urotrichus	1	...	...	...	...	...	...	1
22. Neurotrichus	1	...	...	...	...	...	1	...
23. Uropsilus	1	...	...	...	...	...	...	1
24. Talpa	10	...	...	...	...	1	...	10
25. Scaptonyx	1	...	...	...	...	...	...	1
26. Dymecodon	1	...	...	...	...	...	...	1
27. Scalops	3	...	...	...	...	...	3	...
28. Scapasius	3	...	...	...	...	...	3	...
29. Perascalops	1	...	...	...	...	...	1	...
30. Condylura	1	...	...	...	...	...	1	...
	25	...	...	...	...	1	9	16
FAMILY VII. POTAMOGALIDÆ.								
31. Potamogale	1	...	...	1	...	...	...	...
32. Geogale	1	...	...	...	1	...	...	...
	2	...	...	1	1	...	...	...

Summary and Deductions as regards the Insectivores (continued).

	Total Species.	I. Australian Region.	II. Neotropical Region.	III. Ethiopian Region.	IIIa. Malagasy Region.	IV. Oriental Region.	V. Nearctic Region.	VI. Palearctic Region.
FAMILY VIII. SOLENODONTIDÆ.								
33. Solenodon	2	...	2	...	...	...	...	...
FAMILY IX. CENTETIDÆ.								
34. Centetes	1	...	...	...	1	...	...	...
35. Hemicentetes	3	...	...	...	3	...	...	...
36. Ericulus	4	...	...	...	4	...	...	...
37. Microgale	7	...	...	...	7	...	...	...
38. Oryzoryctes	4	...	...	...	4	...	...	...
39. Limnogale	1	...	...	...	1	...	...	...
40. Echinops	1	...	...	...	1	...	...	...
	21	...	...	...	21	...	...	...
FAMILY X. CHRYSOCHLORIDÆ.								
41. Chrysochloris	7	...	...	7	...	...	...	...

DEDUCTIONS

1. The Order Insectivora consists of ten rather isolated family groups, distributed generally over the earth, except in Australia, where they are absent, and the Malagasy Sub-region and South America, where they are very feebly represented.

2. About 230 species of Insectivores are recognized, arranged in forty-one genera.

3. The most numerous and all-pervading group of Insectivores is the Shrews (*Soricidæ*), of which upwards of 120 species are known.

4. Many of the families of Insectivores are excessively local in distribution, the Kaguans and Tree-shrews being peculiar to the Oriental Region, the Elephant-shrews and Golden Moles to Africa, the Solenodonts to the Greater Antilles, and the Tenrecs to Madagascar.

Section III.—Distribution of Bats

(*a*) *Introductory Remarks*

The Bats, which constitute the Order Chiroptera, are, after the Rodents, the most numerous of all mammals, upwards of 530 species being already recognized, and many others probably awaiting further researches. As regards their distribution, it must be recollected that their powers of flight, which render them capable of passing over tracts of water that could not be crossed by other small mammals, place them in a somewhat different category from ordinary Mammals. At the same time the mode of their occurrence on the earth's surface presents many interesting features, concerning which a few words should be said. In these remarks, however, we shall be brief, as the Bats are not creatures of general interest, and as a rule are little studied except by the scientific worker.

(*b*) *Chief Points in the Distribution of Bats*

The first point to be noticed in the distribution of this extensive Order is, that the members are divisible into two well-marked and easily recognized sections. To the first of these belong the fruit-eating Bats of the family of *Pteropodidæ*, sometimes recognized as a Sub-order under the title "Megachiroptera." This section contains about 110 species, divided into eighteen genera, the whole of which are entirely confined to the tropical and sub-tropical portions of the Eastern Hemisphere, and are quite unknown in the New World. They are spread over the Ethiopian, Oriental, and Australian Regions, the African forms, about five in number, being mostly generically distinct and peculiar to that continent. One of the most remarkable of these is *Epomophorus*, distinguished for its large lips and capacious mouth, of which eleven or twelve species occur in the Ethiopian tropics. In the Oriental and Australian Regions *Epomophorus* is replaced by *Pteropus*, with as many as fifty or sixty species. It is a remarkable fact that *Pteropus* has never reached the African continent, although two of its species occur in the Comoro Islands, only about 200 miles distant from the African coast.

Passing onwards to the five families of Insectivorous Bats, we find the two first of these, the *Rhinolophidæ* and *Nycteridæ* also absent in the New World, although they are distributed in larger or smaller numbers over most portions of the Old World, including Australia. The fourth family, *Vespertilionidæ*, which is the most numerous group of all, embracing some 200 species and twenty

genera, is found in every Region, and seems to pervade nearly the whole of the earth's surface, and to extend far north and south. The common Pipistrelle (*Vespertilio pipistrellus*), ranges into the high north of Europe; while another species of the same genus (*V. magellanicus*) inhabits the cold and desolate shores of the Straits of Magellan.

The Serotine Bat (*V. serotinus*) is remarkable as the only species of Bat that is known to inhabit both the Old and New Worlds, being found in North America as far south as Guatemala. It also extends over a great part of the Oriental and Ethiopian Regions.

The fourth family of Insectivorous Bats, the *Emballonuridæ*, easily distinguished by the tail perforating the inter-femoral membrane or being produced far beyond it, has likewise an extensive distribution, as members of the fifteen genera into which it is divided occur in every one of the six Regions. But these Bats are more abundant within the tropics, and are only feebly represented by a few stray forms in the Nearctic and Palæarctic Regions. Of the two Bats known to occur in New Zealand, one (*Mystacops*) is a member of this family, and is peculiar to New Zealand. This and another Bat (*Chalinolobus morio*), belonging to the family *Vespertilionidæ*, are the only two indigenous mammals of the New Zealand group, the Rat *Mus maorium*, often attributed to it, being probably a modern introduction.

The last family of Bats, the *Phyllostomatidæ*, or Vampires, are entirely restricted to the Neotropical Region, where they form one of the most characteristic groups of mammals, being very numerous alike in species, genera, and individuals. Of the thirty-six genera, with upwards

of eighty species, which belong to this family, the two most remarkable are the purely blood-sucking forms *Desmodus* and *Diphylla*, which present an extraordinary modification of their digestive organs, specially adapting them for a diet of blood. These little animals, in fact, are those which have given such a bad reputation to the whole family of Vampires, though it was formerly supposed that the *Vampirus spectrum*, and other larger forms of tropical America, were likewise sanguinivorous in their habits. But this large Bat is now known, like many other representatives of the same family, to subsist mainly upon fruit, whilst other Vampires feed on a mixed diet of fruit and insects, or on insects only; and others again of the larger forms are said to prey chiefly upon the smaller members of their own order.

(c) *Summary and Deductions as regards the Order Chiroptera.*

Table of the genera of Bats, showing the approximate number of species found in each of the six Regions.

	Total Species.	I. Australian Region.	II. Neotropical Region.	III. Ethiopian Region.	IIIa. Malagasy Region.	IV. Oriental Region.	V. Nearctic Region.	VI. Palæarctic Region.
FAMILY I. PTEROPODIDÆ.								
1. Epomophorus	11	...	...	11	...	...	...	...
2. Pteropus	55	30	...	...	7	20	...	1
3. Pteralopex	1	1	...	...	...	...	...	...
4. Cynonycteris	12	1	...	6	1	3	...	2
5. Cynopterus	12	...	...	...	...	12	...	...
6. Boneia	2	...	...	...	...	2	...	...
7. Harpyonycteris	1	...	...	...	...	1	...	...
8. Scotonycteris	1	...	...	1	...	...	...	...
9. Harpyia	2	2	...	...	...	1	...	...
10. Cephalotes	3	2	...	...	...	1	...	...
11. Liponyx	1	...	...	1	...	...	...	...
12. Notopteris	1	1	...	...	...	...	...	...
13. Eonycteris	1	...	...	...	...	1	...	...
14. Macroglossus	3	2	...	...	...	2	...	...
15. Megaloglossus	1	...	...	1	...	...	...	...
16. Melonycteris	1	1	...	...	...	...	...	...
17. Callinycteris	1	...	...	...	...	1	...	...
18. Nesonycteris	1	1	...	...	...	...	...	...
FAMILY II. RHINOLOPHIDÆ.	110	41	...	20	8	44	...	3
19. Rhinolophus	26	1	...	8	...	17	...	4
20. Trisænops	4	...	...	2	2	...	...	1
21. Rhinonycteris	1	1	...	...	...	...	...	...
22. Phyllorhina	28	7	...	6	1	15	...	1
23. Anthops	1	1	...	...	...	...	...	...
24. Cælops	1	...	...	...	...	1	...	...
FAMILY III. NYCTERIDÆ.	61	10	...	16	3	33	...	6
25. Megaderma	5	1	...	2	...	2	...	...
26. Nycteris	10	...	...	9	...	1	...	...
	15	1	...	11	...	3	...	...

(*c*) *Summary and Deductions as regards the Order Chiroptera* (*continued*).

	Total Species.	I. Australian Region.	II. Neotropical Region.	III. Ethiopian Region.	IIIa. Malagasy Region.	IV. Oriental Region.	V. Nearctic Region.	VI. Palæarctic Region.
FAMILY IV. VESPERTILIONIDÆ.								
27. Antrozous	1	...	...	...	...	...	1	...
28. Nyctophilus	3	3	...	...	...	...	...	...
29. Synotus	2	...	...	...	...	1	...	2
30. Plecotus	3	...	...	...	...	...	2	1
31. Euderma	1	...	...	...	...	...	1	...
32. Otonycteris	1	...	...	...	...	...	...	1
33. Vesperugo	70	4	9	20	1	20	8	15
34. Chalinolobus	8	4	...	4	...	...	...	...
35. Scotophilus	11	2	...	4	1	4	...	...
36. Nycticejus	2	...	1	...	...	...	1	...
37. Atalapha	9	1	5	...	...	...	5	...
38. Harpiocephalus	8	...	...	...	...	5	...	4
39. Vespertilio	45	3	8	5	1	10	5	15
40. Kerivoula	15	1	...	4	...	10	...	...
41. Natalus	3	...	3	...	...	...	...	...
42. Thyroptera	2	...	2	...	...	...	...	...
43. Myxopoda	1	...	...	...	1	...	...	...
44. Miniopterus	5	1	...	2	1	2	...	1
FAMILY V. EMBALLONURIDÆ.	190	19	28	39	5	52	23	39
45. Furia	1	...	1	...	...	...	...	...
46. Amorphochilus	1	...	1	...	...	...	...	...
47. Emballonura	6	2	...	...	1	3	...	...
48. Coleura	2	...	...	2	...	...	...	...
49. Rhynchonycteris	1	...	1	...	...	...	...	...
50. Saccopteryx	6	...	6	...	...	...	...	...
51. Cormura	1	...	1	...	...	...	...	...
52. Taphozous	12	4	...	4	1	4	...	...
53. Diclidurus	2	...	2	...	...	...	...	...
54. Noctilio	3	...	3	...	...	...	...	...
55. Rhinopoma	2	...	...	...	...	1	...	1
56. Cheiromeles	1	...	...	...	...	1	...	...
57. Molossus	10	...	10	...	...	...	1	...
58. Nyctinomus	30	5	8	9	3	4	3	2
59. Mystacops	1	1	...	...	...	...	...	...
	79	12	33	15	5	13	4	3

(*c*) *Summary and Deductions as regards the Order Chiroptera (continued).*

	Total Species.	I. Australian Region.	II. Neotropical Region.	III. Ethiopian Region.	IIIa. Malagasy Region.	IV. Oriental Region.	V. Nearctic Region.	VI. Palæarctic Region.
FAMILY VI. PHYLLOSTOMIDÆ.								
60. Chilonycteris	5	...	5	...	...	...	...	...
61. Mormops	2	...	2	...	...	...	...	...
62. Lonchorhina	1	...	1	...	...	...	...	...
63. Macrotus	3	...	2	...	...	...	2	...
64. Macrophyllum	1	...	1	...	...	...	...	...
65. Vampyrus	2	...	2	...	...	...	...	...
66. Lophostoma	3	...	3	...	...	...	...	...
67. Schizostoma	3	...	3	...	...	...	...	...
68. Glyphonycteris	1	...	1	...	...	...	...	...
69. Trachyops	1	...	1	...	...	...	1	...
70. Phylloderma	1	...	1	...	...	...	...	...
71. Phyllostoma	3	...	3	...	...	...	...	...
72. Tylostoma	2	...	2	...	...	...	...	...
73. Mimon	1	...	1	...	...	...	...	...
74. Carollia	2	...	2	...	...	...	...	...
75. Rhinophylla	1	...	1	...	...	...	...	...
76. Glossophaga	2	...	2	...	...	...	...	...
77. Phyllonycteris	2	...	2	...	...	...	...	...
78. Monophyllus	1	...	1	...	...	...	...	...
79. Ischnoglossa	1	...	1	...	...	...	...	...
80. Lonchoglossa	2	...	2	...	...	...	...	...
81. Glossonycteris	1	...	1	...	...	...	...	...
82. Chœronycteris	3	...	3	...	...	...	...	...
83. Lichonycteris	1	...	1	...	...	...	...	...
84. Artibeus	9	...	9	...	...	...	...	...
85. Vampyrops	7	...	7	...	...	...	...	...
86. Chiroderma	3	...	3	...	...	...	...	...
87. Sternoderma	5	...	5	...	...	...	...	...
88. Ectophylla	1	...	1	...	...	...	...	...
89. Ametrida	2	...	2	...	...	...	...	...
90. Pygoderma	1	...	1	...	...	...	...	...
91. Sturnira	1	...	1	...	...	...	...	...
92. Brachyphylla	1	...	1	...	...	...	...	...
93. Centurio	3	...	3	...	...	...	...	...
94. Desmodus	2	...	2	...	...	...	...	...
95. Diphylla	1	...	1	...	...	...	...	...
	81	...	80	...	...	...	3	...

Deductions

1. The Order of Chiroptera, or Bats, contains about 530 known species which are divided into ninety-five genera and six families.

2. They are found in every part of the world except within the Arctic and Antarctic Circles, and even in many islands where no other mammals occur.

3. The Fruit-bats (*Pteropodidæ*) are met with only in the Old World, and mainly within the tropics.

4. The Vampires (*Phyllostomatidæ*) are entirely restricted to the Neotropical Region, except two or three species (out of eighty) which have passed over the boundaries into the Nearctic Region.

5. Two forms of the Vampires (*Desmodus* and *Diphylla*), having their dentition and digestive organs specially modified for that purpose, feed on the blood of living animals.

Section IV.—Distribution of Rodents

Rodents are by far the most numerous of all the Orders of Mammals, comprising, according to a moderate calculation, nearly 1400 species which are arranged in 159 genera belonging to twenty-one distinct families. They are also among the most universally distributed of terrestrial mammals, being found in all latitudes high and low, and abundant in every part of the earth except Australia, where they are feebly represented by a few genera and species. The Rodents, especially the Mice (*Muridæ*), to which family rather more than half their number belong, are still imperfectly known; their arrangement and classi-

fication have recently undergone important changes, and continual discoveries of new species and new alliances are made by several busy naturalists who are engaged mainly on a study of the smaller mammals. Under these circumstances it is hardly necessary for our present purpose to mention more than the names of most of the twenty-one families which constitute this complicated group, but we shall endeavour to pick out, as we go through them, some of the most noticeable facts connected with the distribution of these mammals.

Adopting Mr. Thomas's recent classification of the genera of this group[1] (with a few slight deviations) as the best authority, we find the *Anomaluridæ*, a singular group of Flying-Squirrel-like Rodents, at the head of the Order. This family, with its three genera (*Anomalurus*, *Idiurus*, and *Zenkerella*), is purely Ethiopian, the eleven or twelve species which are referred to it occurring only in tropical Africa. Passing on to the next family, the Squirrels (*Sciuridæ*), we have an extensive group of about 240 species divided into eleven genera distributed nearly all over the earth's surface, with the exception of the Australian Region and Madagascar, where they are entirely deficient. The most numerous genus is that of the true Squirrels (*Sciurus*) which, subject to the exception just mentioned, is fairly distributed over the whole of the earth.

The *Castoridæ*, or Beavers, which come next, are represented in the present day only by the genus *Castor*, with two species, one of which occurs in the high latitudes of the Palæarctic and the other in those of the Nearctic

[1] "On the genera of Rodents," *P. Z. S.* 1896, p. 1012. *Cf.* Palmer, "Science," N. S., vi., p. 103 (1897).

Region. These two species are closely allied and perhaps scarcely distinguishable.

The *Haplodontiidæ*, or Sewellels, allied to the Squirrels, contain only the single genus *Haplodontia*, the species of which are confined to the Nearctic Region.

In the fourth family of the Rodents we meet with more familiar objects. The *Gliridæ*, or Dormice, with six genera and about nineteen or twenty species, have a curious distribution, being found only in the Ethiopian, Oriental, and Palæarctic Regions. Each of these Regions, however, has its peculiar genera, true *Glis* and its allies belonging to the Palæarctic Region, whilst *Graphiurus* is strictly Ethiopian, and the two remaining genera are restricted to the Oriental Region.

We now come to the Mice, or *Muridæ*, which, as already indicated, are exceedingly numerous and all-pervading creatures. Mr. Thomas places the 730 species of this family in seventy-eight genera. Mice are most numerous, perhaps, in the tropics, but are also well represented in Arctic latitudes, and in the shape of Lemmings (*Lemmus*), extend far towards the Pole.

They are not abundant in Australia proper, being represented there chiefly by the peculiar genus *Hydromys* and a few species of *Mus*. In Madagascar the seven genera of *Muridæ* met with are likewise altogether restricted to that anomalous island.

The Mole-rats (*Spalacidæ*), which follow next in Mr. Thomas's series, are a small and peculiar group, the members of which imitate the subterranean life of the Moles. The typical genus *Spalax*, with eight species, is confined to the Palæarctic Region, whilst the Bamboo Rats (*Rhizomys*), represent the group in

the Oriental Region and *Tachyoryctes* in the Ethiopian Region.

The Pocket-gophers (*Geomyidæ*), which are entirely restricted to the Nearctic Region, contain only two genera and nine species. Allied to them are the *Heteromyidæ*, a more numerous group of seventy or eighty species, entirely restricted to the New World, and, with the exception of a few stray species of Pocket-mice (*Heteromys*), to the Nearctic Region.

The tenth family of Rodents, the *Bathyergidæ*, belong entirely to the Ethiopian Region, over which they are thinly represented by fifteen or sixteen species. The Naked Sand-Rat of Southern Abyssinia and Somaliland (*Heterocephalus glaber*), is one of the most extraordinary-looking Mammals in the world, being almost entirely without hair and covered with a yellowish naked skin; it is subterranean in its habits.

The *Dipodidæ*, or Jerboas, which we now come to, are well known for the great length of the hind limbs and the kangaroo-like manner of their progression; they consist of six genera and about thirty-three species, all of which, except one (*Zapus*), are restricted to the Palæarctic Region. The six species of *Zapus*, are spread over the Nearctic Region from the far North down to Mexico, where, however, they are restricted to the highlands.

Allied to the Jerboas is the Jumping-Hare (*Pedetes caffer*), which forms an allied family of itself, and is restricted to Southern and South-eastern Africa.

We now arrive at the series of Porcupiny Rodents, of which as many as seven families are usually recognized. These are mostly found in the Neotropical Region, and four of them indeed, the *Chinchillidæ*, *Dasyproctidæ*,

Dinomyidæ, and *Caviidæ*, containing what are usually called the Chinchillas, Agoutis, Giant-mice, and Cavies, are entirely restricted within its limits, while a fifth family, the *Erethizontidæ*, or Tree-Porcupines, has a single genus in the Nearctic Region.

The *Octodontidæ*, a large group of seventy or eighty species, divided into some twenty-two genera, are also mostly Neotropical, but four peculiar types, *Ctenodactylus*, *Massoutiera*, *Pectinator*, and *Petromys* forming a little group by themselves, are Ethiopian. The true Porcupines, *Hystricidæ*, of which three genera are known, are found in the Ethiopian, Oriental, and Palæarctic Regions, typical *Hystrix* being the only one met with in Europe and Northern Asia.

Finally, at the close of the long series of Rodents, we have the two groups of Pikas and Hares, markedly differing from the nineteen previous families in their dentition, and therefore assigned to a separate Sub-order of Rodents as *Duplicidentati*. The Pikas (*Ochotoma*), of which some sixteen species are recognized, are restricted to the highlands of the Nearctic and Palæarctic Regions. The Hares (*Leporidæ*) have a much wider distribution, having representatives in every part of the world's surface except in the Australian Region and Madagascar. Of *Lepus* proper some sixty species are now recognized, the greater number of which occur in the Palæarctic and Nearctic Regions, whilst they are generally scarcer further south, though well represented in Africa.

Section V.—Summary and Deductions

Table of genera of Rodents, showing the geographical distribution of the species.

Distribution of Rodents

	Total Species.	I. Australian Region.	II. Neotropical Region.	III. Ethiopian Region.	IIIa. Malagasy Region.	IV. Oriental Region.	V. Nearctic Region.	VI. Palaearctic Region.
Family I. ANOMALURIDÆ.								
1. Anomalurus	9	...	...	9	...	...	...	...
2. Idiurus	1	...	...	1	...	...	...	...
3. Zenkerella	1	...	...	1	...	...	...	...
	11	...	...	11	...	...	...	...
Family II. SCIURIDÆ.								
4. Reithrosciurus	1	...	...	...	...	1	...	...
5. Xerus	5	...	...	4	...	...	...	1
6. Sciurus	106	...	12	17	...	60	15	3
7. Tamias	30	...	...	...	...	...	30	1
8. Spermophilus	40	...	...	...	...	...	24	16
9. Cynomys	4	...	...	...	...	...	4	...
10. Arctomys	10	...	...	...	...	...	4	6
11. Eupetaurus	1	...	...	...	...	1	...	...
12. Petaurista	13	...	...	...	...	13	...	...
13. Sciuropterus	24	...	...	...	...	17	5	2
14. Nannosciurus	5	...	...	1	...	4	...	...
	239	...	12	22	...	96	82	29
Family III. CASTORIDÆ.								
15. Castor	2	...	...	...	...	...	1	1

Distribution of Rodents (*continued*).

	Total Species.	I. Australian Region.	II. Neotropical Region.	III. Ethiopian Region.	IIIa. Malagasy Region.	IV. Oriental Region.	V. Nearctic Region.	VI. Palæarctic Region.
Family IV. HAPLODONTIIDÆ.								
16. Haplodontia	2	...	...	...	...	...	2	...
Family V. GLIRIDÆ.								
17. Glis	1	...	...	...	...	...	...	1
18. Muscardinus	1	...	...	...	...	...	...	1
19. Eliomys	2	...	...	...	...	...	...	2
20. Graphiurus	13	...	...	13	...	...	...	...
21. Platacanthomys	1	...	...	...	...	1	...	...
22. Typhlomys	1	...	...	...	...	1	...	...
	19	...	...	13	...	2	...	4
Family VI. MURIDÆ.								
23. Hydromys	4	4	...	...	...	...	...	...
24. Xeromys	1	1	...	...	...	...	...	...
25. Celænomys	1	...	...	...	...	1	...	...
26. Chrotomys	1	...	...	...	...	1	...	...
27. Crunomys	1	...	...	...	...	1	...	...
28. Rhynchomys	1	...	...	...	...	1	...	...
29. Phlæomys	1	...	...	...	...	1	...	...
30. Gerbillus	38	...	...	20	...	2	...	16
31. Pachyuromys	2	...	...	1	...	...	...	1
32. Meriones	13	...	...	2	...	1	...	10
33. Psammomys	2	...	...	...	...	...	...	2
34. Rhombomys	1	...	...	...	...	...	...	1
35. Otomys	4	...	...	4	...	...	...	...
36. Oreinomys	1	...	...	1	...	...	...	...
37. Deomys	1	...	...	1	...	...	...	...
38. Dendromys	6	...	...	6	...	...	...	...
39. Limacomys	1	...	...	1	...	...	...	...
40. Steatomys	4	...	...	4	...	...	...	...

DISTRIBUTION OF RODENTS (*continued*).

	Total Species.	I. Australian Region.	II. Neotropical Region.	III. Ethiopian Region.	IIIa. Malagasy Region.	IV. Oriental Region.	V. Nearctic Region.	VI. Palaearctic Region.
41. Malacothrix	1	...	...	1	...	...	...	...
42. Mus	130	30	...	30	...	50	...	20
43. Nesokia	12	...	...	...	...	8	...	4
44. Cricetomys	1	...	...	1	...	...	...	...
45. Malacomys	3	...	...	3	...	...	...	...
46. Lophuromys	4	...	...	4	...	...	...	...
47. Saccostomus	3	...	...	3	...	...	...	...
48. Acomys	10	...	...	7	...	...	...	3
49. Arvicanthis	10	...	...	9	...	...	...	2
50. Dasymys	4	...	...	4	...	...	...	...
51. Golunda	3	...	...	2	...	1	...	...
52. Vandeleuria	1	...	...	...	...	1	...	...
53. Chiropodomys	3	...	...	...	...	3	...	...
54. Batomys	1	...	...	...	...	1	...	...
55. Carpomys	2	...	...	...	...	2	...	...
56. Pogonomys	8	8	...	...	...	...	...	...
57. Hapalomys	1	...	...	...	...	1	...	...
58. Pithecochomys	1	...	...	...	...	1	...	...
59. Lenomys	1	...	...	...	...	1	...	...
60. Crateromys	1	...	...	...	...	1	...	...
61. Mallomys	1	...	...	...	...	1	...	...
62. Craurothrix	1	1	...	...	...	...	...	...
63. Mastacomys	1	1	...	...	...	...	...	...
64. Uromys	8	8	...	...	...	...	...	...
65. Conilurus	16	16	...	...	...	...	...	...
66. Lophiomys	1	...	...	1	...	...	...	...
67. Cricetus	12	...	...	...	...	...	...	12
68. Mystromys	1	...	...	1	...	...	...	...
69. Brachytarsomys	1	...	...	...	1	...	...	...
70. Nesomys	1	...	...	...	1	...	...	...
71. Hallomys	1	...	...	...	1	...	...	...
72. Brachyuromys	2	...	...	...	2	...	...	...
73. Hypogeomys	1	...	...	...	1	...	...	...
74. Gymnuromys	1	...	...	...	1	...	...	..
75. Eliurus	4	...	...	...	4	...	...	...
76. Onychomys	8	...	...	...	...	...	8	...
77. Peromyscus	30	...	...	...	...	...	30	...
78. Rhipidomys	12	...	12	...	...	...	...	...
79. Tylomys	3	...	3	...	...	...	...	...
80. Holochilus	4	...	4	...	...	...	...	...

Distribution of Rodents (*continued*).

	Total Species.	I. Australian Region.	II. Neotropical Region.	III. Ethiopian Region.	IIIa. Malagasy Region.	IV. Oriental Region.	V. Nearctic Region.	VI. Palaearctic Region.
81. Megalomys	1	...	1	...	...	...	...	...
82. Ligmodon	7	...	...	...	...	...	7	...
83. Oryzomys	66	...	60	...	...	...	6	...
84. Chilomys	1	...	1	...	...	...	...	...
85. Reithrodontomys	12	...	3	...	...	...	9	...
86. Eligmodontia	6	...	6	...	...	...	...	...
87. Nectomys	7	...	7	...	...	...	...	...
88. Neotomys	1	...	1	...	...	...	...	...
89. Reithrodon	5	...	5	...	...	...	...	...
90. Phyllotis	5	...	5	...	...	...	...	...
91. Scapteromys	2	...	2	...	...	...	...	...
92. Ichthyomys	4	...	4	...	...	...	...	...
93. Acodon	40	...	40	...	...	...	...	...
94. Oxymycterus	8	...	8	...	...	...	...	...
95. Blarinomys	1	...	1	...	...	...	...	...
96. Notiomys	1	...	1	...	...	...	...	...
97. Neotoma	33	...	1	...	...	...	33	...
98. Nelsonia	1	...	...	...	...	...	1	...
99. Xenomys	1	...	...	...	...	...	1	...
100. Hodomys	1	...	...	...	...	...	1	...
101. Phenacomys	6	...	...	...	...	...	6	...
102. Evotomys	19	...	...	...	...	...	14	5
103. Microtus (Arvicola)	80	...	...	...	...	...	40	40
104. Synaptomys	7	...	...	...	...	...	7	...
105. Lemmus (Myodes)	4	...	...	...	...	...	1	3
106. Dicrostonyx	1	...	...	...	...	...	1	1
107. Ellobius	4	...	...	...	...	...	...	4
108. Siphneus	5	...	...	...	...	...	...	5
109. Fiber	3	...	...	...	...	...	3	...
	724	69	162	106	11	79	171	129
Family VII. SPALACIDÆ.								
110. Rhizomys	5	...	...	...	...	5	...	...
111. Tachyoryctes	3	...	...	3	...	...	...	...
112. Spalax	8	...	...	...	...	...	...	8
	16	...	...	3	...	5	...	...

Distribution of Rodents (*continued*).

	Total Species.	I. Australian Region.	II. Neotropical Region.	III. Ethiopian Region.	IIIa. Malagasy Region.	IV. Oriental Region.	V. Nearctic Region.	VI. Palearctic Region.
Family VIII. GEOMYIDÆ.								
113. Geomys	8	...	...	...	...	...	8	...
114. Thomomys	1	...	...	...	...	...	1	...
Family IX. HETEROMYIDÆ.	9	...	...	...	...	...	9	...
115. Dipodomys	12	...	...	...	...	...	12	...
116. Perodipus	10	...	...	...	...	...	10	...
117. Microdipodops	1	...	...	...	...	...	1	...
118. Perognathus	38	...	...	...	...	...	38	...
119. Heteromys	15	...	3	...	...	...	12	...
Family X. BATHYERGIDÆ.	76	...	3	...	...	...	73	...
120. Bathyergus	1	...	...	1	...	...	...	...
121. Georychus	10	...	...	10	...	...	...	...
122. Myoscalops	3	...	...	3	...	...	...	...
123. Heterocephalus	2	...	...	2	...	..	...	...
Family XI. DIPODIDÆ.	16	...	...	16	...	...	...	...
124. Sminthus	4	...	...	...	...	...	...	4
125. Zapus	7	...	...	...	...	...	6	1
126. Dipus	10	...	...	...	...	...	...	10
127. Alactaga	10	...	...	...	...	...	...	10
128. Platycercomys	1	...	...	...	...	...	...	1
129. Euchoreutes	1	...	...	...	...	...	...	1
Family XII. PEDETIDÆ.	33	...	...	...	...	...	6	27
130. Pedetes	1	...	...	1	...	...	...	...

DISTRIBUTION OF RODENTS (*continued*).

	Total Species.	I. Australian Region.	II. Neotropical Region.	III. Ethiopian Region.	IIIa. Malagasy Region.	IV. Oriental Region.	V. Nearctic Region.	VI. Palæarctic Region.
FAMILY XIII. OCTODONTIDÆ.								
131. Ctenodactylus	1	...	...	1	...	...	...	...
132. Massoutiera	2	...	...	1	...	...	...	1
133. Pectinator	1	...	...	1	...	...	...	...
134. Petromys	1	...	...	1	...	...	...	...
135. Ctenomys	9	...	9	...	...	...	...	...
136. Acondemys (Schizodon)	1	...	1	...	...	...	...	...
137. Spalacopus	1	...	1	...	...	...	...	...
138. Octodon	4	...	4	...	...	...	...	...
139. Habrocoma	2	...	2	...	...	...	...	...
140. Dactylomys	1	...	1	...	...	...	...	...
141. Thrinacodus	1	...	1	...	...	...	...	...
142. Cannabatomys	1	...	1	...	...	...	...	...
143. Loncheres	18	...	18	...	...	...	...	...
144. Trichomys	4	...	4	...	...	...	...	...
145. Cercomys	1	...	1	...	...	...	...	...
146. Carterodon	1	...	1	...	...	...	...	...
147. Mesomys	4	...	4	...	...	...	...	...
148. Echinomys	13	...	13	...	...	...	...	...
149. Myocastor	1	...	1	...	...	...	...	...
150. Capromys	5	...	5	...	...	...	...	...
151. Plagiodontia	1	...	1	...	...	...	...	...
152. Thryonomys (Aulacodus)	4	...	...	4	...	...	...	...
FAMILY XIV. HYSTRICIDÆ.	77	...	68	8	...	...	...	1
153. Hystrix	12	...	...	3	...	7	...	2
154. Atherura	4	...	...	3	...	1	...	...
155. Trichys	1	...	...	...	...	1	...	...
FAMILY XV. ERETHIZONTIDÆ.	17	...	...	6	...	9	...	2
156. Erethizon	2	...	...	...	...	...	2	...
157. Cercolabes	9	...	9	...	...	...	...	...
158. Chætomys	1	...	1	...	...	...	...	...
	12	...	10	...	...	...	2	...

Distribution of Rodents (*continued*).

	Total Species	I. Australian Region.	II. Neotropical Region.	III. Ethiopian Region.	IIIa. Malagasy Region.	IV. Oriental Region.	V. Nearctic Region.	VI. Palæarctic Region.
Family XVI. CHINCHILLIDÆ.								
159. Chinchilla	1	...	1	...	...	...	...	...
160. Lagidium	3	...	3	...	...	...	...	...
161. Lagostomus	1	...	1	...	...	...	...	...
Family XVII.	5	...	5	...	...	...	...	...
DASYPROCTIDÆ.								
162. Dasyprocta	12	...	12	...	...	...	...	...
163. Cœlogenys	2	...	2	...	...	...	...	...
Family XVIII.	14	...	14	...	...	...	...	...
DINOMYIDÆ.								
164. Dinomys	1	...	1	...	...	...	...	...
Family XIX. CAVIIDÆ.								
165. Cavia	11	...	11	...	...	...	...	...
166. Dolichotis	2	...	2	...	...	...	...	...
167. Hydrochœrus	1	...	1	...	...	...	...	...
Family XX.	14	...	14	...	...	...	...	...
OCHOTONIDÆ.								
168. Ochotona (Lagomys)	16	...	...	...	...	...	3	13
Family XXI. LEPORIDÆ.								
169. Romerolagus	1	...	1	...	...	...	...	...
170. Lepus	60	...	4	10	...	3	20	25
	61	...	5	10	...	3	20	25

Deductions

1. The Order Rodentia is the most numerous of all the chief Mammalian groups, containing nearly 1400 species, which are divided into 170 genera and 21 families.

2. The Rodents are distributed all over the world both in temperate and tropical climes, and are abundant everywhere, both in species and individuals, except in Australia where they are poorly represented.

3. The most all-pervading and numerous family of the Rodents is the *Muridæ* (Mice), which are upwards of 600 in number and are the only members of the group met with in Australia and Madagascar. In Madagascar the *Muridæ* are represented by a small group of indigenous genera.

4. The Porcupine-like Rodents, of which there are seven families, are specially characteristic of the New World, only the typical Porcupines (*Hystricidæ*) and five peculiar genera of Octodonts being inhabitants of the New World.

5. Two families of Rodents, the Pocket-gophers (*Geomyidæ*) and the Kangaroo-rats (*Heteromyidæ*), are specially characteristic of the Nearctic Region, the Jerboas (*Dipodidæ*) of the Palæarctic, and the Sand-rats (*Bathyergidæ*) of the Ethiopian Region.

CHAPTER XII

DISTRIBUTION OF HYRAXES, ELEPHANTS, AND UNGULATES

Section I.—Distribution of Hyraxes

The Hyraxes and Elephants are nowadays often annexed to the Ungulates, and arranged only as Sub-orders of that great Order, to some members of which they have been shown to be more or less allied by forms of life now extinct. But as, in the present case, we are dealing only with existing mammals, it seems better to give to these two groups their full rank as "Orders," which they have an abundance of special characters to justify. The Hyraxes, of which, taking Mr. Thomas's recently published account[1] as our guide, about fourteen species belonging to the single genus *Hyrax* are more or less accurately known, may be regarded as a characteristic form of the Ethiopian Region. As shown by Mr. Thomas's map (*op. cit.* p. 58) they are distributed all round the coast of Africa from Senegal through the Cape to Upper Egypt, and also in many places, where they have been searched for, in the interior. Beyond the African continent they extend through Arabia into the borders of Palestine, where the celebrated "coney" of the Scriptures (*Hyrax syriacus*)

[1] "On the species of the *Hyracoidea*," by O. Thomas, *P. Z. S.* 1892, p. 50.

is met with. The Hyraxes are, in most cases, inhabitants of arid rocks, but in other cases are strictly arboreal in their habits.

Summary and Deductions as regards the Order Hyraxes

	Total.	I. Australian.	II. Neotropical.	III. Ethiopian.	IIIa. Malagasy.	IV. Oriental.	V. Nearctic.	VI. Palæarctic.
1. Hyrax	14	...	...	14	...	...	...	...

1. The Order Hyraces contains a single genus (*Hyrax*) forming a single family Hyracidæ with about fourteen known species.

2. They are found only in the Ethiopian Region, including Arabia and South Palestine.

Section II.—Distribution of Elephants

Of this grand form of animal life, formerly much more abundant on the earth's surface, there remain in the present epoch but two species, one of which is a characteristic form of the Ethiopian Region and the other of the Indian Region. The African Elephant, which, besides its external peculiarities, should be referred from the structure of its teeth according to some authorities to the sub-genus *Loxodon* of the palæontologists, was formerly found in suitable spots all over the continent of Africa from the Sahara and Upper Nubia down to the Cape. In these days it has in most places been driven by the sportsmen

and hunters for ivory far into the interior, but is still to be found in enormous herds in some of the more remote localities of Africa. In the Cape Colony the only spot where it is said still to exist is the forests of the Knysna.

The Indian Elephant (*Elephas indicus*) inhabits the forest-lands of British India, Ceylon, Burma, the Malay Peninsula, and Sumatra. Its occurrence in Borneo in a wild state has not yet been certainly ascertained. In India, according to Mr. Blanford, Elephants are still found wild along the base of the Himalayas, also in the great forest-countries between the Ganges and the Kistna, in the Western Ghats, and in the forest-clad ranges of Nagpore, but in former times their range was naturally much more extensive. Attempts have been made to separate the Elephants of Ceylon and Sumatra from the continental form as different species, but though there are some grounds for so doing, the distinctions have not been satisfactorily established. The Indian Elephant may be regarded as a characteristic form of the Oriental Region, as the African Elephant is of the Ethiopian.

Although we are here only dealing with species of mammals actually in existence, it should be borne in mind that the Mammoth (*E. primigenius*) has only comparatively recently ceased to exist on the earth, as is proved by the frozen carcasses of this Elephant that have been exhumed in the tundras of Northern Siberia, and by the enormous abundance of its fossil teeth, which are, even at the present day, a recognized article of commerce. The Mammoth had a very different distribution from the two existing Elephants and was essentially Palæarctic in its range, although it appears to have extended across Behring Strait into Alaska.

Summary and Deductions as regards the Order Proboscidea

	Total.	I. Australian.	II. Neotropical.	III. Ethiopian.	IIIa. Malagasy.	IV. Oriental.	V. Nearctic.	VI. Palæarctic.
1. Elephas	2	...	...	1	...	1	...	...

1. The Order Proboscidea contains only the genus *Elephas* (forming a family Elephantidæ) with two existing species.

2. One of these belongs to the Oriental and the other to the Ethiopian Region.

Section III.—General Distribution of the Ungulates

The Ungulates which we now arrive at, and which constitute the ninth order of mammals according to the arrangement here adopted, contain the greater number of the largest and most highly developed forms of the whole class of mammals and embrace in their varied series nearly all the animals (such as the Horse, Sheep, Goat, Ox, Deer, Camel, and Pig) which are most useful to mankind, although we cannot always recognize the original stocks from which the domesticated forms of these animals have descended. The mode of the distribution of these Mammals over the earth's surface is, therefore, of special interest, and we must say something about each of the groups into which they are usually divided in classification. The 300 species of Ungulates usually recognized constitute

about seventy-one genera which are referred to thirteen families. Some of these families, however, have only one or two species at present existing to represent them, and the great mass of Ungulates, taking them as a whole, belong to the Ox-family, *Bovidæ*, which contains about 200 species.

Section IV.—Distribution of Rhinoceroses

We will begin the Ungulates with what is called by naturalists the Perissodactyle section, which, although abundant in former ages, is represented in the present state of the earth's fauna only by three distinct types forming so many families, the Rhinoceroses, the Tapirs, and the Horses. In each of these families there remain a few species only, the relics of a vast number of ancestors which have preceded them.

Of the existing *Rhinocerotidæ* only five well-ascertained forms are known, two of which belong to Africa and three to India, although many other species have been suggested upon more or less sufficient evidence. The Rhinoceroses of the Ethiopian Region belong to quite a distinct section of the genus from the Oriental form. These two animals commonly, though not very correctly, called the "Black" and "White" Rhinoceroses, are best distinguished by the shape of the upper lip, which in the "Black" Rhinoceros is long, pointed, and extensile, and in the "White" Rhinoceros is short, square, and truncated. The Short-lipped Rhinoceros (*Rhinoceros simus*), now nearly extinct, has never been met with north of the Zambesi River, which forms the northern boundary of many of the peculiar mammals of the Cape district. On the other hand, the

Black Rhinoceros (*R. africanus*) extends from the Cape all up the Eastern side of Africa into the plains of the Atbara and Upper Nile.

The Oriental Rhinoceroses are three in number. Two of these have only one horn on the nose, while the third is provided with two of these appendages. Of the former the large Indian Rhinoceros (*R. unicornis*) appears to be confined to the North-eastern provinces of the Indian Peninsula, whilst the smaller one-horned form (*R. sondaicus*) ranges from the Sunderbunds of Bengal through the Malay Peninsula down to Java, Sumatra, and perhaps Borneo. The third Oriental species, the Sumatran Rhinoceros (*R. sumatrensis*), has nearly the same range as the last-named species, but appears to extend rather farther north. Thus we may consider the existing Rhinoceroses as typical forms of the Ethiopian and Oriental Regions, but not to be met with in any other part of the world's surface.

Section V.—Distribution of Tapirs

The second family of Perissodactyle Ungulates, the Tapirs, has a still more remarkable distribution. Out of the five known species four belong to the Neotropical Region, while the fifth, which in some respects is more closely allied to one of the American Tapirs than the American Tapirs are to one another, is an inhabitant of the Oriental Region, being met with only in the Malay Peninsula and Sumatra. This is a good instance of the rare phenomenon of "discontinuous distribution" which, however, may be explained by the fact known from geology

that the Tapirs were formerly a prevalent group over a large portion of the earth's surface, so that in these days we have only to deal with a few scattered remnants of a former considerable series.

Of the American Tapirs two (*Tapirus bairdi* and *T. dowi*) are found in Central America, a third (*T. roulini*) occurs in the Andes of Colombia and Peru, and a fourth (*T. americanus*) is widely distributed over the South American continent from Venezuela to Paraguay.

The Tapirs may be therefore considered as a characteristic form of the Neotropical and Oriental Regions, and a "lipomorph" or absent form in all other parts of the world's surface.

Section VI.—Distribution of Horses

The third family of Perissodactyle Ungulates comprises the Horses (*Equidæ*),[1] now a very isolated group, although allied to the Tapirs by many extinct intermediate forms. The Horses at present known to exist in a state of nature belong to about nine species, of which three may be attributed to the Palæarctic Region and six to the Ethiopian. Among the Palæarctic species the recently discovered *Equus prjevalskii* of the deserts of Central Asia is the sole living representative of the typical section of the genus *Equus* with callosities on both the fore and hind limbs. The other eight species all belong to the Asinine section, with callosities upon the hind limbs only. Unless it shall turn out to have been *Equus prjevalskii*, the exact

[1] On the species of Horse, consult Sir William Flower's "The Horse" (London, 1891, Kegan Paul & Co.).

progenitor of our domestic Horse is extinct, but it was in all probability of Palæarctic origin.

The two Asses of Asia are the Kiang of High Tibet (*Equus kiang*), which is a larger animal clad with a thick coat of fur in winter, and the smaller, more sandy-coloured and thin-coated Onager (*Equus onager*), which occurs in many parts of the deserts of Western Asia and intrudes into the Oriental Region in Cutch. Passing on to Africa we find two members of the Asinine section still wild in the North-eastern part of that continent. These are *Equus tæniopus* of the deserts of Nubia and *E. somalicus* of Somaliland. The former of these was probably the origin of our domestic Ass (*Equus asinus*). Going farther southwards into Africa we meet with four distinct species of the beautifully striped Asses commonly called Zebras, viz. (1) the Quagga (*E. quagga*) of the Cape Colony, now nearly, if not quite, extinct; (2) the Mountain Zebra (*E. zebra*) also confined to Africa south of the Zambesi, and now becoming extremely rare; (3) Burchell's Zebra (*E. burchelli*) distributed under slightly varying characters from the Transvaal to British East Africa along the eastern portion of the continent; and (4) Grévy's Zebra (*E. grevii*) of southern Abyssinia and Somaliland.

The Horses (*Equidæ*) of the present epoch may, therefore, be regarded as characteristic of the Palæarctic and Ethiopian Regions.

Section VII.—Distribution of Bovine Mammals

At the head of the great Arctiodactyle section of the Ungulates, which we now enter upon, we meet with the

numerous and important family *Bovidæ*, to the variety and extent of which in the present day we have already alluded. The *Bovidæ* in fact contain nearly two-thirds of the species of Ungulate animals now existing on the world's surface, and embrace at least 200 species belonging to forty-five distinct genera, amongst which are the Sheep, Ox, and Goat, the animals of which the flesh is mostly used for food by civilized man.

According to the arrangement of Flower and Lydekker, the *Bovidæ* are divisible into about ten sub-families, the seven first of which embrace the mammals commonly known as Antelopes. These are mostly met with in the more open districts of the Ethiopian Region, where in former days they roamed about in exuberant multitudes, but have been sadly diminished at the present time by the persecutions of the sportsman and the hunter. We have not space here to go into the numerous and varied forms of Antelopes, but must refer our readers who wish for special information on that subject to "The Book of Antelopes" now in process of publication. It must suffice to say that the roll of Antelopes numbers some 150 species, of which 9 are attributable to the Palæarctic Region, 4 to the Oriental, and 135 to the Ethiopian Region. Three of the Oriental species belong to peculiar genera restricted to that Region, and the fourth is a Gazelle, a member of a genus which is also well represented in the Palæarctic and Ethiopian Regions. It is therefore evident that the Antelopes, although slightly represented elsewhere, form one of the most predominant and characteristic features of the Ethiopian Region.

The *Rupicaprinæ*, forming the eighth sub-family of *Bovidæ*, and containing what are commonly called the

Mountain-Antelopes, have a very different distribution. They are absolutely unknown in the Ethiopian Region, and are found mostly in the Palæarctic Region with stray species in the Oriental and Nearctic Regions. The well-known Chamois (*Rupicapra*) is the typical form of this group. It is confined to the western portion of the Palæarctic Region, and is the single species of the genus. In Eastern Palæarctica it is represented by the genera *Cemas* and *Nemorhædus*, some species of which occur also on the higher mountain-ranges of the Oriental Region. In the Nearctic Region the Rocky Mountain Goat (*Haplocerus montanus*) is the sole representative of the Mountain-Antelopes.

The Goats and Sheep (*Caprinæ*), which follow next, have nearly the same sort of distribution. It should be mentioned that the distinctive differences between the Goats and Sheep, from a structural point of view, are very difficult to define; and that the two forms are so nearly allied that it has been proposed by some naturalists to unite them into one genus. The *Caprinæ* altogether, although by no means satisfactorily worked out at present, may be held to embrace some twenty-six species, of which nineteen are Palæarctic, two are Nearctic, five are Oriental, and one species only (*Capra walie* of the high ranges of Abyssinia) occurs within the confines of the Ethiopian Region. The *Caprinæ* are represented in the Nearctic Region by two, or possibly three, species of Sheep, which extend from Alaska, along the main range, nearly down to Northern Mexico.

Finally closing the long list of the family *Bovidæ* we have the oxen, or typical *Bovinæ*, embracing about twelve or thirteen species, and thinly distributed over the

Palæarctic and Oriental Regions, but with certainly one Nearctic representative, and two, or possibly three, in the Ethiopian Region. The true origin of our domestic cattle (*Bos*), is lost in obscurity, but is usually attributed to Palæarctic ancestors, although the progenitor of the humped form, or Zebus, may have more probably been Oriental. The two Bisons belong, one to the Palæarctic and one to the Nearctic Regions, and are very nearly allied. The Yak (*Poephagus*) is confined to the higher mountain ranges of Central Asia, and must be therefore reckoned as Palæarctic. The characteristic Oriental forms of bovine animals are the Bantengs (*Bibos*), of which subgenus three species are commonly recognized. The Bantengs extend from the mountains of Northern India through the ranges of the Malay Peninsula into the Sondaic Islands. Of the Buffaloes (*Bubalus*) three species are commonly recognized, one of which is Indian, the parent of the well-known domestic form, while two, or perhaps three, other nearly allied species are peculiar to Africa. Finally, closely allied to the Buffaloes, and hardly distinguishable from them, we have the little Anoa of Celebes, and the lately discriminated *Bubalus mindorensis* of the Philippine Islands.

Section VIII.—Distribution of Prongbucks

The second family of Artiodactyle Ungulates embraces only a single species strictly confined to the Nearctic Region, and constituting one of its most peculiar types. This is the Prongbuck (*Antilocapra americana*), of the western prairies of the United States, which (as was first

ascertained in this country) carries hollow horns, like those of the *Bovidæ*, but sheds them regularly every year, like the deciduous antlers of the Stags.

Section IX.—Distribution of Giraffes

The next family of Arctiodactyles, the Giraffidæ, consists likewise of what is called a monotypic form, embracing a single species only, and limited, in the present epoch, entirely to one Region of which it is one of the most characteristic animals. The Giraffe (*Giraffa camelopardalis*) is distributed over the greater part of Africa, from Senegal through the Southern Sahara to Upper Nubia, and thence southward throughout Eastern Africa in suitable localities to the Cape. So far as we know at present it is not found within the great wooded regions of the Congo valley and western coast, but is certainly met with on the Niger and on the Upper Gambia. As has recently been well shown by Mr. de Winton (*P. Z. S.* 1897, p. 273) the Giraffe presents us with two geographical forms, which may be designated either as species or sub-species. The Northern Giraffe (*Giraffa camelopardalis typica*) which is met with in Senegal and thence across the Sahara to Upper Nubia, Somaliland, and British East Africa is distinguished from the Southern Giraffe (*Giraffa camelopardalis capensis*) by several characters, especially by the great prominence of the third frontal horn which is barely apparent in the southern Giraffe. The Cape Giraffe seems to be met with in suitable localities all up the east coast into British East Africa, where it is stated that the two forms meet. More accurate information about the two forms of Giraffe

is, however, highly desirable, and the areas of the two sub-species require to be carefully studied.

Section X.—Distribution of Deer

The seventh family of Ungulates which we now come to, though it cannot rival the *Bovidæ*, is likewise of importance in an economic point of view, the flesh of nearly all the Deer-tribe forming an acceptable food for mankind. In our survey of the deer we shall follow as nearly as possible Mr. Lydekker's "Deer of all Lands," the most recent and best authority on the subject. Mr. Lydekker acknowledges eleven genera of this family, containing altogether nearly sixty species. Of these genera ten belong to the typical Deer and one to the Musk-deer (*Moschus*).

Deer are found in all the six Regions of the world except the Australian and Ethiopian. Their absence in Australia, as is the case with nearly all the highly organized groups of mammals, can be easily understood, but it is difficult to imagine why there should be no Deer in the Ethiopian Region, when in the New World they have passed so abundantly into South America. We are not aware that any explanation can be given of this anomaly, unless it be that their place is taken by the Antelopes. Commencing with the Reindeer (*Rangifer*) and the Elk (*Alces*), we find these two types restricted to the northern portions of the Palæarctic and Nearctic Regions. Whether it is possible to recognize more than one species of each of these forms is a matter of doubt. At any rate all the local races of both the genera are closely allied.

The true Deer (*Cervus*), which we come to next, form the most numerous genus of the family, being about twenty-two in number. They are about equally divided between the Palæarctic and the Oriental Regions, with one representative, the Wapiti (*C. canadensis*) in the Nearctic Region. This occurrence is exactly in a line with that of the stray species of Sheep (*Ovis*), Bison (*Bos*), and Mountain Antelope (*Haploceros*) in the same Region, but is not sufficient, supported though it may be by other similar facts, to convince us of the necessity of recognizing a "Holarctic" Region. It should be stated also that typical *Cervus* is essentially characteristic of the Palæarctic Region, throughout which (with the above-mentioned exception of the Wapiti) the members of this splendid group of animals are distributed, whilst the sub-genera *Axis*, *Rusa*, and *Rucervus* take its place in the Oriental Region.

The Muntjacs (*Cervulus*) embrace about five species essentially Oriental, although two of them intrude within the bounds of the Palæarctic Region.

In the curious form *Elaphodus* we meet with a Deer with a tufted head which nearly conceals its minute antlers, restricted to the northern portion of the Palæarctic Region, and leading us on to the Water-Deer (*Hydrelaphus*) of Southern China, in which the antlers are absolutely wanting.

Of the Roes (*Capreolus*) there seem to be three local races, which are often considered as so many species. These allied forms range over the whole extent of the Palæarctic Region.

We now come to that strange animal the Milou (*Elaphurus*) which has been sometimes associated with

the true *Cervi*, but which, as has been recently pointed out by Mr. Lydekker, possesses essentially distinctive characters in its remarkable horns, large and spreading hoofs, and long tail, besides other peculiarities. Mr. Lydekker is of opinion that the genus "has nothing to do with any of the living Old World Deer except the Roes, whilst its alliance with the American Deer (*Cariacus*) seems to be close." If such be the case its *patria* is indeed remarkable, for, though only yet certainly known from captive specimens obtained in the Imperial Park, near Pekin, it is said to have been originally brought from Kashgaria, and must therefore be a Palæarctic form.

The second section of the sub-family *Cervinæ* contains the American Deer of which two genera are usually recognized—*Cariacus*[1] and *Pudua*—containing altogether at least twenty or twenty-one species, which are distributed throughout the Nearctic and Neotropical Regions. As all naturalists agree they form a very natural group, connected by many common characters which separate them from all the existing Deer of the Old World, although the fossil genus *Anoglochis*, formerly found in Western Europe, seems to have been a closely allied form. As in the case of *Cervus* the sub-divisions of *Cariacus* have special areas of distribution, *Dorcelaphus* being the most northern form, whilst *Blastocerus*, *Xenelaphus*, and *Subulo* take its place in South America. The small Deer

[1] We regret not to be able to follow Mr. Lydekker in using the generic term *Mazama* for this group. *Mazama* is a term which has already been most carefully studied and condemned by the late Professor Baird ("North American Mammals," p. 665) to be rejected for vagueness. Its author, Rafinesque, seems to have been an erratic person whose writings should be held to be of no authority whatever, and it is very doubtful whether any of his names, which were mainly based on the phantoms of his own imagination, should be employed in Science.

of the genus *Pudua*, distinguished from *Cariacus* by its remarkable foot-structure, consists of two species, one from Chili and Western Patagonia and the other from the high Andes of Ecuador.

The Musk-Deer which constitute a second well-defined sub-family of the *Cervidæ* and should perhaps even be recognized as a different family, contains only the genus *Moschus*, with two species, which are restricted to the Palæarctic Region.

Section XI.—Distribution of Chevrotains

The *Tragulidæ*, or Chevrotains, consist of a few animals of small size, often known as Moose-Deer, which are intermediate in structure between the Deer, the Camels, and the Pigs. There are only two known genera of these animals at present existing, of which one (*Tragulus*), with about five species, belongs to the Oriental Region and the other (*Hyomoschus*), with a single species, is peculiar to Western Africa. The latter form is closely allied, if not identical with the extinct *Dorcatherium* of the tertiaries of the Old World, and is placed by some authorities in the same genus. Other extinct forms of small Ungulates serve to connect the Chevrotains, in former epochs, with the Deer.

Section XII.—Distribution of the Camels

The forms of the Camel family now existing are two only, the true Camels of the Old World and the Lamas of the New. These are now separate in structure as in

locality, but seem to be alike descendants of a group of extinct Camel-like ancestors formerly found in North America. The two species of *Camelus* now living are the One-humped Camel (*C. dromedarius*) and the Two-humped or Bactrian Camel (*C. bactrianus*) both of which are now best known in a domestic state. Indeed the original home of the One-humped Camel has not yet been certainly ascertained, although it is usually supposed to have been Arabia, where wild Camels are said to have existed about the commencement of the present epoch. We may therefore, perhaps, class the Arabian Camel as an Ethiopian type. But the true home of the Bactrian or Two-humped Camel is certainly the great deserts of Central Asia, where specimens of the wild species have been obtained both by Russian and English explorers. We may therefore place the Bactrian Camel as a Palæarctic animal.

The two wild species of Lama—the Huanaco and Vicuna—are found only in the temperate portions of the Neotropical Region; from one or both of these are descended the Lamas and Alpacas of domesticity. The Lamas may consequently be classed as an indigenous form of the Neotropical Region.

Section XIII.—Distribution of Swine-like Ungulates

At the end of the great Ungulate series we come to the Swine or Swine-like mammals, of which the existing forms are usually assigned to four separate families, the Hippopotamuses, Wart-Hogs, true Swine, and Peccaries. Most of these forms, except the Swine, have in these days

a very limited distribution, but in former days the whole series was connected, in locality as in form, by hosts of ancestors now extinct.

The *Hippopotamidæ*, or Hippopotamuses, formerly widely-spread over the whole world, have now only two surviving species, the larger *Hippopotamus amphibius*, which is met with in nearly all the great African lakes and rivers, and the smaller Liberian Hippopotamus (*H. liberiensis*) which has hitherto been found only in one of the rivers of Liberia. As regards the existing creation, therefore, this peculiar form of Ungulates must be regarded as strictly Ethiopian.

The second family of Swine-like Ungulates—the Wart-hogs (*Phacochœridæ*)—is also entirely confined to Africa, where two species are widely distributed from Upper Nubia, throughout Eastern Africa, down to the Cape Colony.

The true *Suidæ*, or Swine, to which the Wart-hogs are indeed closely allied, embrace three genera—*Sus*, *Potamochœrus* and *Babirussa*. The typical Swine (*Sus*) are found in the southern part of the Palæarctic and the Oriental Regions, extending from Southern Europe, through Western Asia into India and the islands of the Indian Archipelago. It is difficult in many cases to ascertain what are the real wild species of this group, the domestic forms having varied much under domestication for many ages and having been carried by man all over the world. It is probable that the Swine of New Guinea—the so-called *Sus papuensis*—and those of other Eastern islands may be descendants of domestic or semi-domestic animals.

In the Ethiopian Region the place of *Sus* is taken by the River-hog (*Potamochœrus*), with a slightly different

dentition. Two or perhaps three distinct species of this genus have been generally recognized, but the recent researches of Dr. Forsyth Major (*cf. P. Z. S.* 1897, p. 359) tend to show that we are by no means yet well acquainted with the species of this difficult group. The third genus of *Suidæ*, the Babirussa, remarkable for the peculiar shape of its four tusks, exists only in the far-away island of Celebes and (perhaps introduced) in the adjacent island of Bouru. It must, therefore, be attributed to the Oriental Region, to which, we believe, we have now definitely shown (see above, p. 146) that Celebes must be referred.

The fourth and last family of Swine-like Ungulates contains only the Peccaries (*Dicotyles*) of the New World. The two species belonging to this genus range from Texas and the Southern United States down to Patagonia; and must be regarded as purely Neotropical in their geographical classification, although one of the species—the Collared Peccary—undoubtedly intrudes slightly within the boundaries of the Nearctic Region.

Section XIV.—Summary and Deductions

Table of the genera of the Order Ungulata with the numbers of species belonging to the great Zoological Regions.

	Total.	I. Australian.	II. Neotropical.	III. Ethiopian.	IIIa. Malagasy.	IV. Oriental.	V. Nearctic.	VI. Palearctic.
Family I. RHINOCEROTIDÆ.								
1. Rhinoceros	5	...	...	2	...	3	...	...
Family II. TAPIRIDÆ.								
1. Tapirus	5	...	4	...	...	1	...	...
Family III. EQUIDÆ.								
1. Equus	9	...	...	6	...	...	...	3
Family IV. BOVIDÆ.								
Sub-family I. Bubalidinæ.								
1. Bubalis	8	...	...	8	...	...	...	...
2. Damaliscus	7	...	...	7	...	...	...	...
3. Connochætes	2	...	...	2	...	...	...	...
Sub-family II. Cephalophinæ.								
4. Cephalophus	38	...	...	38	...	...	...	...
5. Tetraceros	1	...	...	...	...	1	...	...
Sub-family III. Neotraginæ.								
6. Oreotragus	1	...	...	1	...	...	...	...
7. Ourebia	5	...	...	5	...	...	...	...
8. Raphicerus	2	...	...	2	...	...	...	...
9. Nesotragus	1	...	...	1	...	...	...	...
10. Neotragus	1	...	...	1	...	...	...	...
11. Madoqua	6	...	...	6	...	...	...	...

Summary and Deductions (*continued*).

	Total.	I. Australian.	II. Neotropical.	III. Ethiopian.	IIIa. Malagasy.	IV. Oriental.	V. Nearctic.	VI. Palæarctic.
Sub-family IV. Cervicaprinæ.								
12. Cobus	12	...	...	12	...	...	...	...
13. Cervicapra	5	...	...	5	...	...	...	...
14. Pelea	1	...	...	1	...	...	...	...
Sub-family V. Antilopinæ.								
15. Antilope	1	...	...	...	...	1	...	...
16. Æpyceros	2	...	...	2	...	...	...	...
17. Saiga	1	...	...	...	...	...	...	1
18. Pantholops	1	...	...	...	...	...	...	1
19. Antidorcas	1	...	...	1	...	...	...	...
20. Gazella	25	...	...	17	...	1	...	7
21. Ammodorcas	1	...	...	1	...	...	...	...
22. Lithocranius	1	...	...	1	...	...	...	...
23. Dorcotragus	1	...	...	1	...	...	...	...
Sub-family VI. Hippotraginæ.								
24. Hippotragus	4	...	...	4	...	...	...	...
25. Oryx	5	...	...	5	...	...	...	...
26. Addax	1	...	...	1	...	...	...	...
Sub-family VII. Tragelaphinæ.								
27. Boselaphus	1	...	...	...	...	1	...	...
28. Tragelaphus	8	...	...	8	...	...	...	...
29. Strepsiceros	2	...	...	2	...	...	...	...
30. Orias	3	...	...	3	...	...	...	...
Sub-family VIII. Rupicaprinæ.								
31. Rupicapra	1	...	...	...	...	...	...	1
32. Cemas	4	...	...	...	...	1	...	3
33. Nemorhedus	5	...	...	...	...	1	...	4
34. Haplocerus	1	...	...	...	...	...	1	...
35. Budorcas	2	...	...	...	...	...	...	2

SUMMARY AND DEDUCTIONS (*continued*).

	Total.	I. Australian.	II. Neotropical.	III. Ethiopian.	IIIa. Malagasy.	IV. Oriental.	V. Nearctic.	VI. Palearctic.
Sub-family IX. CAPRINÆ.								
36. Capra	10	...	...	1	...	2	...	8
37. Hemitragus	3	...	...	...	...	3	...	...
38. Ovis	12	...	...	...	...	...	2	10
39. Ovibos	1	...	...	...	...	...	1	...
Sub-family X. BOVINÆ.								
40. Bos	2	...	...	...	...	1	...	1
41. Bison	2	...	...	...	...	...	1	1
42. Poephagus	1	...	...	...	...	...	...	1
43. Bibos	3	...	...	...	...	3	...	...
44. Bubalus	3	...	...	2	...	1	...	...
45. Anoa	2	...	...	...	...	2	...	...
FAMILY V. ANTILOCAPRIDÆ.	200	...	...	138	...	18	5	40
1. Antilocapra	1	...	...	...	...	...	1	...
FAMILY VI. GIRAFFIDÆ.								
1. Giraffa	1	...	...	1	...	...	...	...
FAMILY VII. CERVIDÆ.								
(*a*) CERVINÆ.								
1. Rangifer	1	...	...	...	...	...	1	1
2. Alces	1	...	...	...	...	...	1	1
3. Cervus	22	...	...	...	...	10	1	11
4. Cervulus	5	...	...	...	...	3	...	2
5. Elaphodus	2	...	...	...	...	...	...	2
6. Hydrelaphus	1	...	...	...	...	1	...	...
7. Capreolus	3	...	...	...	...	...	...	3
8. Elaphurus	1	...	...	...	...	...	...	1
9. Cariacus	19	...	15	...	...	...	4	...
10. Pudua	2	...	2	...	...	...	...	...
(*b*) MOSCHINÆ.								
11. Moschus	2	...	...	...	...	...	...	2
	59	...	17	...	...	14	7	23

SUMMARY AND DEDUCTIONS (*continued*).

	Total.	I. Australian.	II. Neotropical.	III. Ethiopian.	IIIa. Malagasy.	IV. Oriental.	V. Nearctic.	VI. Palæarctic.
FAMILY VIII. TRAGULIDÆ.								
1. Tragulus	5	...	...	...	...	5	...	...
2. Hyomoschus	1	...	...	1	...	...	...	...
	6	...	...	1	...	5	...	...
FAMILY IX. CAMELIDÆ.								
1. Camelus	2	...	...	1	...	...	...	1
2. Lama	2	...	2	...	...	...	...	...
	4	...	2	1	...	...	...	1
FAMILY X. HIPPOPOTAMIDÆ.								
1. Hippopotamus	2	...	...	2	...	...	...	...
FAMILY XI. PHACOCHŒRIDÆ.								
1. Phacochœrus	2	...	...	2	...	...	...	...
FAMILY XII. SUIDÆ.								
1. Sus	5	...	...	...	...	4	...	1
2. Potamochœrus	4	...	...	3	1	...	...	...
3. Babirussa	1	...	...	...	...	1	...	...
	10	...	...	3	1	5	...	1
FAMILY XIII. DICOTYLIDÆ.								
1. Dicotyles	2	...	2	...	...	...	...	...

Deductions

1. The Order Ungulata contains about 306 known species, arranged in seventy-one genera and thirteen families.

2. Ungulates are found all over the earth except in the Australian Region. In the Malagasy Sub-region there is but one species, which may possibly be a recent introduction.

3. Ungulates are most abundant in the Ethiopian Region, where 156 species occur. Of the great family Bovidæ 138 out of 200 known species are restricted to this Region.

4. There are no Bovine Ungulates in the Neotropical Region, and only five (all nearly allied to recent or extinct Palæarctic forms) in the Nearctic Region.

5. In the Neotropical Region there are representatives of only four out of the thirteen families of Ungulates—Tapirs, Deer, Camels, and Peccaries.

6. There are no Deer (*Cervidæ*) in the Ethiopian Region.

7. The New World has only 38 species of Ungulates against 270 found in the Old World.

CHAPTER XIII

DISTRIBUTION OF THE CETACEANS AND SIRENIANS

In a previous chapter on this subject (Chapter VIII., p. 197) I have already stated the principal facts known respecting the distribution of these two marine orders of mammals and need not now repeat them. But I append a list of the genera with the approximate numbers of the generally recognized species and some general indications of their ranges, and I add some general deductions.

Table of the genera of the Order Cetacea, showing the approximate number of valid species and their distribution.

	Number of Species.	
SUB-ORDER MYSTACOCETI.		
Family I. BALÆNIDÆ.		General Distribution.
1. Balæna	2	Arctic, Temperate and Antarctic Seas.
2. Neobalæna	1	Antarctic.
3. Rhachianectes . . .	1	North Pacific.
4. Megaptera	1	Atlantic and Pacific, North and South.
5. Balænoptera. . . .	4	Widely distributed.
	9	

	Number of Species.	
SUB-ORDER ODONTOCETI.		
Family II. PHYSETERIDÆ.		
Sub-family I. PHYSETERINÆ.		
1. Physeter	1	Tropical and Sub-tropical Seas.
2. Cogia	1	Widely distributed.
Sub-family II. ZIPHINÆ.		
3. Hyperoodon	2	North Atlantic.
4. Ziphius	2	Widely distributed.
5. Mesoplodon	6	Widely distributed.
6. Berardius	1	Antarctic and Pacific.
	13	
Family III. PLATANISTIDÆ.		
1. Platanista	1	Rivers Ganges, Brahmaputra, and Indus.
2. Inia	1	Upper Amazon.
3. Pontoporia	1	Estuary of La Plata.
	3	

Genus.	Number of Species.	
Family IV. DELPHINIDÆ.		
Sub-family I. **Delphininæ.**		General Distribution.
1. Sotalia	9	China, Indian Ocean, South America (partially fluviatile)
2. Steno	2	Indian Ocean and South Atlantic.
3. Tursiops	5	Widely diffused.
4. Delphinus	4	Widely diffused.
5. Prodelphinus	8	Widely diffused.
6. Tursio	2	Antarctic and Pacific Ocean.
7. Lagenorhynchus	9	Widely diffused.
8. Sagmatias	1	Unknown.
9. Teresa	1	Antarctic Ocean.
10. Cephalorhynchus	4	South Seas.
11. Neomeris	1	Indian Ocean.
12. Phocæna	3	Atlantic and Pacific Ocean.
13. Orcella	2	Indian Ocean and Trawnddy River.
14. Grampus	1	Atlantic and Pacific.
15. Globicephalus	6	Widely diffused.
16. Pseudorca	1	Widely diffused.
17. Orca	1	Widely diffused.
Sub-family II. **Delphinapterinæ.**		
18. Delphinapterus	1	Arctic Seas.
19. Monodon	1	Arctic Seas.
	62	

Deductions

1. The Order Cetacea contains from eighty to ninety known species, belonging to about forty-four genera and four families.

2. Cetaceans are found in all seas from the Equator to within the Arctic and Antarctic Circles, and in some of the larger rivers (the Ganges, Brahmaputra, Indus, and Irawadi in the Old World, and the Amazon and La Plata in the New).

3. The species of Oceanic Cetaceans are mostly very widely distributed, especially the Delphinidæ, but in some cases are local, some species being confined to the Arctic and Antarctic Seas respectively, and some being peculiar to the Pacific and to the North Atlantic.

4. The Fluviatile Dolphins proper constitute a family of themselves (*Platanistidæ*) with a very singular distribution, one genus being restricted to the rivers of India, and two others to those of South America.

5. Besides the Platanistidæ some of the Delphinidæ are found in rivers, such as *Orcella fluminalis* in the Irawadi, and *Sotalia tucuxi* (with perhaps others of the same genus) in the Amazon.

6. None of the great lakes of any continent is known to be inhabited by Cetaceans.

CHAPTER XIV

DISTRIBUTION OF EDENTATE MAMMALS

Section I.—Introductory Remarks

As is the case with most ancient groups, we find the various types of Edentate Mammals strictly limited to certain localities on the earth's surface, so that the study of their distribution, especially when taken in connection with what we know of the extinct forms of the same group, comes to be a matter of much interest. In the present case, however, we propose to confine our remarks to the existing Edentates, as we are discussing the distribution of recent and not of fossil mammals, and merely to allude to the extinct forms when necessary.

As regards the existing Edentates, as has been well shown by one of our leading authorities on mammals, those of the Old World and those of the New are essentially distinct. The two Old World families commonly assigned to this order, are so different in important points of structure from the American families, that it may be even considered doubtful whether they were derived from the same primary branch of mammals. We will, therefore, take the two groups separately, and begin with the forms of the New World.

Section II.—Distribution of the New World Edentates

The Edentates of the New World are at present represented by three families, the Sloths (*Bradypodidæ*), the Ant-eaters (*Myrmecophagidæ*), and the Armadilloes (*Dasypodidæ*), all well distinguished from each other, although essentially modified on the same plan of structure, and more or less united together by other Edentates now extinct. All three families belong entirely to the Neotropical Region, although one of the Armadilloes appears to have intruded itself farther north than the generally recognized northern boundary of that Region.

Of the Sloths, two genera are well established—the Three-toed Sloths (*Bradypus*), with about five species, and the Two-toed Sloths (*Cholopus*), with two species. The Sloths are entirely arboreal in their habits, and are met with only in the dense forests of Central and Southern America, from Nicaragua down to Bolivia and Southern Brazil.

The Ant-eaters, of which three well-marked forms are known, belonging to so many genera, each with one species, have a somewhat wider distribution, being not absolutely confined to the tropical forests. The Great Ant-eater (*Myrmecophaga jubata*), extends as far north as Guatemala, and from Costa Rica southwards is found in suitable localities all through Venezuela, Guiana, and Brazil to Paraguay.

The Tamandua Ant-eater (*Tamandua tetradactyla*), which varies much in colour and markings, extends even farther north than its larger brother, as specimens have

been obtained in Southern Mexico. Southwards it passes throughout South America as far as Paraguay, where Rengger assures us it is common, and widely distributed. The little Two-toed Ant-eater (*Cyclothurus didactylus*), a purely arboreal form, is also found in Guatemala, Nicaragua, and Costa Rica, but does not range so far south as the two former species, though it extends throughout the great Amazonian valley into Peru.

The *Dasypodidæ*, or Armadilloes, which contain the third family of American Edentates, are more numerous and more diversified in their characters than the two preceding families. The eighteen or twenty species generally recognized by naturalists may be divided into four sub-families and seven genera. The general area of their distribution is rather larger than that of the Sloths and Ant-eaters. One Armadillo, as has been already mentioned, goes as far north as Texas, and Armadilloes are found all over the Argentine Republic down to Patagonia.

The most remarkable of the Armadilloes, and one that must form a sub-family by itself, is the little Pichy-ciego of the Argentines (*Chlamydophorus truncatus*), which is found in the sandy plains of the vicinity of Mendoza, and also, as has been recently ascertained, near Bahia Blanca in the eastern part of the Argentine Republic. A second species of this genus, more recently discovered (*C. retusus*) is met with in Bolivia.

The typical *Dasypodinæ*, consisting of about eleven or twelve species divided among four genera, are distributed all over the area of the family, south of Panama, but do not range into Central America, so far as has hitherto been ascertained.

The Giant Kangaroo (*Priodon gigas*), which belongs to

this sub-family, is the largest Armadillo known, measuring about three feet in the length of its body: it inhabits the forests of Guiana and Brazil. The three species of *Tolypeutes*, which have the power of rolling themselves up into a ball like a Woodlouse, are restricted to the pampas of Argentina and Bolivia. The members of the two other genera of Dasypodinæ (*Dasypus* and *Xenurus*) range from Guiana to Patagonia, but are mostly met with in the south.

Of the third sub-family (*Tatusiinæ*), distinguished from the rest of the group by the peculiar structure of the fore-feet, five species, all belonging to the genus *Tatusia*, are known. One of these, the Peba Armadillo, passes up through Central America into Texas, and is also widely distributed throughout South America down to Paraguay. Another species of this genus, *T. hirsuta*, distinguished by its thick covering of hair, occurs in Western Peru, and the remainder are found in different parts of South America.

The very curious Armadillo, described in 1872 by M. Milne-Edwards (*Nouv. Arch. d. Mus.*, vii., p. 177, 1871) from an imperfect specimen as *Scleropleura bruneti*, is from the province of Ceara, North Brazil. It should apparently form a sub-family of itself.

Section III.—Distribution of the Old World Edentates

The Old World mammals, placed in the Order of Edentates, perhaps more from the want of a better position for them than for any other reason, belong to two families —the *Maniidæ*, or Pangolins, and the *Orycteropodidæ*, or

Aard-Vaarks. Of the Pangolins about seven species are generally acknowledged by naturalists, of which three belong to the Oriental and four to the Ethiopian Region. The species of each region belong to different sections of the genus. The Oriental Section consists of the Javan Pangolin (*Manis javanica*), which ranges from Burma through the Malay Peninsula to Java and Borneo; the Chinese Pangolin (*M. aurita*) from China, Assam, and Nepal; and the Indian Pangolin (*M. pentadactyla*) of India and Ceylon. Of the four species of the African section only one (Temminck's Pangolin) occurs out of the West African Sub-region, extending into Eastern and Southern Africa. Finally we have the *Orycteropodidæ*, or Aard-Vaarks, which comprehend only the single genus *Orycteropus*, with two species entirely restricted to the Ethiopian Region, and forming one of its most characteristic types of mammal-life.

Section IV.—Summary and Deductions

Table of the families and genera, showing the number of species in each Region.

	Total.	I. Australian.	II. Neotropical.	III. Ethiopian.	IIIa. Malagasy.	IV. Oriental.	V. Nearctic.	VI. Palæarctic.
Family I. BRADYPODIDÆ.								
1. Bradypus	5	...	5	...	...	...	...	...
2. Cholopus	2	...	2	...	...	...	...	...
	7	...	7	...	...	...	...	...

SUMMARY AND DEDUCTIONS (*continued*)

	Total.	I. Australian.	II. Neotropical.	III. Ethiopian.	IIIa. Malagasy.	IV. Oriental.	V. Nearctic.	VI. Palæarctic.
FAMILY II. MYRMECOPHAGIDÆ.								
1. Myrmecophaga . . .	1	...	1	...	...	...	...	...
2. Tamandua	1	...	1	...	...	...	...	...
3. Cycloturus	1	...	1	...	...	...	...	...
	3	...	3	...	...	...	...	...
FAMILY III. DASYPODIDÆ.								
(*a*) CHLAMYDOPHORINÆ.								
1. Chlamydophorus . .	2	...	2	...	...	...	...	...
(*b*) DASYPODINÆ.								
2. Dasypus	4	...	4	...	...	...	...	...
3. Xenurus	3	...	3	...	...	...	...	...
4. Prionodon	1	...	1	...	...	...	...	...
5. Tolypeutes	3	...	3	...	...	...	...	...
(*c*) TATUSIINÆ.								
6. Tatusia	5	...	5	...		...	...	...
(*d*) SCLEROPLEURINÆ.					...			
7. Scleropleura	1	...	1	...	...	...	...	...
	19	...	19	...	...	...	...	...
FAMILY IV. MANIDÆ.								
1. Manis	7	...	...	4	...	3	...	...
FAMILY V. ORYCTEROPODIDÆ.								
1. Orycteropus	2	...	...	2	...	...	...	...

Deductions

1. The Order Edentata contains about thirty-eight species, referable to fourteen genera and five families.

2. The Order is predominantly Neotropical, three of the families (the Sloths, Ant-eaters, and Armadilloes) with twenty-nine out of the thirty-eight species being confined to this Region.

3. Of the two remaining families one (the Aard-Vaarks) is purely Ethiopian, and the other (the Pangolins) is common to the Ethiopian and Oriental Region.

CHAPTER XV

DISTRIBUTION OF MARSUPIALS AND MONOTREMES

Section I.—Introductory Remarks

The distribution of the two lowest orders of mammals, at which we have now arrived, is a comparatively simple matter, as these primitive creatures, which, according to the views of the highest authorities, form two primary sub-classes of the whole class of Mammals (*Metatheria* and *Prototheria*), are confined exclusively to two of the great Zoological Regions of the earth. We will, nevertheless, pass the different families and the principal genera of these two orders in short review, and endeavour to point out the principal known facts of their distribution.

Section II.—Distribution of the Marsupials

The Marsupials have, until recently, been classified in six families, five of which belong to the Australian and one only to the Neotropical Region, and such was the plan of arrangement adopted for them by Mr. Thomas in his excellent catalogue of this group of mammals published in 1888. But great discoveries in this class have been made during the past ten years. A new Marsupial, of a most

remarkable form of structure, necessitating the formation of a new family, has been found in Australia, and Mr. Thomas himself has shown the necessity of adding to the Neotropical section a Marsupial which is more allied to the Australian forms than to those previously known from America, and which necessitates the creation of a second Neotropical family. We have now, therefore, to deal with eight families of Marsupials, six of which belong to the Australian Region and two to America. These families embrace altogether about 172 species, of which 144 are Australian and 28 are American. According to Mr. Thomas's arrangement, these are divisible into two large groups, the Diprotodonts, which are mostly vegetable-eating animals, and the Polyprotodonts, which feed generally on flesh and insects.

Section III.—Distribution of Diprotodont Marsupials

The Kangaroos, or *Macropodidæ*, which form the first family of the Diprotodont section, are a numerous group embracing altogether more than sixty known species. These are distributed all over the Australian Region, but are specially abundant in Australia, where, as is well known, the Kangaroos form one of the most striking features of its peculiar mammal-life. In New Guinea and the Papuan Islands Kangaroos are by no means so abundant, especially those of the genus *Macropus* and the larger allied forms. On the other hand *Dorcopsis* and other smaller forms of Kangaroos range through the Papuan Sub-region up to Wallace's line, and New Guinea is especially peculiar

for its Tree-kangaroos (*Dendrolagus*), although this genus likewise occurs in the tropical forests of Northern Queensland.

The second family of Diprotodont Marsupials—the Phalangers (*Phalangeridæ*) is likewise diffused over the whole Australian Region, and has even crossed the dividing line into Celebes, which, as already shown, must be included in the Oriental Region in spite of its possessing this single Marsupial form. This family contains some thirty-five species divided into twelve genera. The typical genus *Phalanger* is a characteristic form of the Papuan Subregion, and only touches Australia at its northern extremity. It is of this genus that two species (*P. ursinus* and *P. celebensis*) occur in Celebes, to which island and the adjacent Sanghir Islands, so far as is at present known, they are restricted. Two of the genera of this family are so distinct from the remainder as to be generally assigned the rank of sub-families of themselves. These are the curious little *Tarsipes*, restricted to Western Australia, and the Koala, or native Bear (*Phascolarctus*), which is widely distributed in Eastern Australia but does not occur outside of it.

Next to the Phalangers we must, I suppose, place the new family of American Marsupials called by Mr. Thomas *Epanorthidæ*, as he refers the single genus yet known of it to the extinct *Epanorthidæ* of Ameghino, which he considers ought to include the recent as well as the fossil members of that nearly extinct group. According to Mr. Thomas the Neotropical *Cænolestes* is clearly a Diprotodont Marsupial, as not only does it possess the characteristic development of the lower incisors, but even its molar teeth resemble most closely in structure those of certain members of the Australian family *Phalangeridæ*. Of *Cænolestes*

only two species have as yet been discovered, one from the mountains of Ecuador and the other from the interior of Colombia.

The fourth and only remaining family of Diprotodont Marsupials is the *Phascolomyidæ*, or Wombats, of which three species are generally distinguished, all belonging to the more temperate regions of Australia and extending into Tasmania, to which island *Phascolomys ursinus* is restricted.

Section IV.—Distribution of Polyprotodont Marsupials

Like the Diprotodonts the Polyprotodont Marsupials now known embrace three Australian and one American family, which are all, as already remarked, generally carnivorous and insectivorous and but rarely omnivorous in their diet. The *Peromelidæ*, or Bandicoots, which are placed at the head of the list, are very distinct in structure and sharply defined from their relatives by the syndactylism of the hind feet, consist of three genera only—*Perogale*, which is restricted to the continent of Australia, and *Peromeles*, which ranges over New Guinea, the Moluccas, and the New Britain group, its representatives in these islands being specifically distinct. The last genus is a very peculiar little animal, the Pig-footed Bandicoot (*Chœropus*) which is restricted to the Australian continent.

Between the *Peromelidæ* and the *Dasyuridæ* is perhaps the best place for the very anomalous mole-like form of Marsupials which has recently come to light in Central Australia. We need not again descant on the extra-

ordinary form and habits of *Notoryctes typhlops*, the sole representative of the family *Notoryctidæ*, an inhabitant of the most barren and desolate regions of the Australian Continent.

In the *Dasyuridæ*, under which family are ranged the most purely carnivorous animals of the Australian mammal-fauna, we have a widely diffused and more numerous group consisting of some seven genera and about twenty-eight species. The largest of these is the Thylacine, now confined to Tasmania, but formerly found also on the adjoining continent. Its extraordinary dog-like appearance strikes the ordinary spectator with astonishment, when he is told that it is in no way nearly related to the Canidæ. It is, however, truly and purely carnivorous in its habits, as is its smaller ally *Sarcophilus ursinus*, also in these days entirely restricted to Tasmania. The Dasyures (*Dasyurus*), of which five species constitute the next genus, are the largest carnivorous mammals now existing in Australia, where four species are recognized, a fifth being restricted to New Guinea. The three next genera of *Dasyuridæ* contain numerous small insectivorous forms, which are found in the Papuan Subregion as well as in Australia. The series of Dasyures is concluded by the peculiar little form *Myrmecobius*, or "Marsupial Ant-eater" as it is often called. This is so different from the typical Dasyures that it may be more correctly regarded as constituting a family by itself, and is of special interest as being generally supposed to be a near relative of the Mesozoic Polyprotodont Marsupials of the Jurassic beds of England.

We now come to the eighth and last family of the Marsupial Order. It consists of the Opossums, which are,

as already stated, peculiar to the Neotropical Region, where they seem to take the place of the absent Insectivores. The Opossums are best arranged in two genera only, *Didelphys* with about twenty-five species, and the very distinct Water Opossum (*Chironectes*) with a single species only. The Tree Opossums (*Didelphys*) of which Mr. Thomas recognizes five sub-genera, are distributed all over the Neotropical Region and a single species, *Didelphys virginiana*, is a well-known inhabitant of the southern United States, and is therefore unquestionably a Nearctic mammal. Whether, however, it is certainly indigenous there, a remnant of the Marsupial-life of the tertiaries, or whether it may not have extended its range northwards from Central America in more recent times it is hard to say. Certain it is that the Virginian Opossum is very closely allied to its South American representative *Didelphys azaræ*, and by some authors is considered merely as a sub-species. Besides the Virginian Opossum five others of the same genus are registered by Alston as occurring within the boundaries of the Central American Sub-region. The remaining species of *Didelphys* are distributed all over South America down to Paraguay and La Plata, and one species at least occurs in Chili to the west of the Andes.

The Water Opossum (*Chironectes*) has likewise a wide distribution—from Guatemala to Southern Brazil, but it is absolutely restricted to the Neotropical Region.

Section V.—Summary and Deductions

Table of the genera of the Order Marsupialia, showing the distribution of the species.

	Total.	I. Australian.	II. Neotropical.	III. Ethiopian.	IIIa. Malagasy.	IV. Oriental.	V. Nearctic.	VI. Palæarctic.
Family I. MACROPODIDÆ.								
1. Macropus	30	30	...	...	...	...	...	...
2. Petrogale	6	6	...	...	...	...	...	...
3. Onychogale	3	3	...	...	...	...	...	...
4. Lagorchestes	4	4	...	...	...	...	...	...
5. Dorcopsis	3	3	...	...	...	...	...	...
6. Dendrolagus	4	4	...	...	...	...	...	...
7. Lagostrophus	1	1	...	...	...	...	...	...
8. Æpyprymnus	1	1	...	...	...	...	...	...
9. Bettongia	4	4	...	...	...	...	...	...
10. Caloprymnus	1	1	...	...	...	...	...	...
11. Potorous	3	3	...	...	...	...	...	...
12. Hypsiprymnodon	1	1	...	...	...	...	...	...
	61	61	...	...	...	...	...	...
Family II. PHALANGERIDÆ.								
1. Tarsipes	1	1	...	...	...	...	...	...
2. Acrobates	1	1	...	...	...	...	...	...
3. Distæchurus	1	1	...	...	...	...	...	...
4. Dromicia	4	4	...	...	...	...	...	...
5. Gymnobelideus	1	1	...	...	...	...	...	...
6. Petaurus	5	5	...	...	...	...	...	...
7. Dactylopsila	1	1	...	...	...	...	...	...
8. Petauroides	2	2	...	...	...	...	...	...
9. Pseudochirus	10	10	...	...	...	...	...	...
10. Trichosurus	2	2	...	...	...	...	...	...
11. Phalanger	6	6	...	...	...	2	...	...
12. Phascolarctus	1	1	...	...	...	...	...	...
	35	35	...	...	...	2	...	...

SUMMARY AND DEDUCTIONS (*continued*).

	Total.	I. Australian.	II. Neotropical.	III. Ethiopian.	IIIa. Malagasy.	IV. Oriental.	V. Nearctic.	VI. Palæarctic.
FAMILY III. EPANORTHIDÆ.								
1. Cænolestes	2	...	2	...	...	...	...	...
FAMILY IV. PHASCOLOMYIDÆ.								
1. Phascolomys	3	3	...	...	...	...	...	...
FAMILY V. PEROMELIDÆ.								
1. Perogale	2	2	...	...	...	...	...	...
2. Peromeles	13	13	...	...	...	...	...	...
3. Chœropus	1	1	...	...	...	...	...	...
FAMILY VI. NOTORYCTIDÆ.	16	16	...	...	...	...	...	...
1. Notoryctes	1	1	...	...	...	...	...	...
FAMILY VII. DASYURIDÆ.								
1. Thylacinus	1	1	...	...	...	...	...	...
2. Sarcophilus	1	1	...	...	...	...	...	...
3. Dasyurus	5	5	...	...	...	...	...	...
4. Phascologale	14	14	...	...	...	...	...	...
5. Sminthopsis	5	5	...	...	...	...	...	...
6. Antechinomys . . .	1	1	...	...	...	...	...	...
7. Myrmecobius	1	1	...	...	...	...	...	...
FAMILY VIII. DIDELPHYIDÆ.	28	28	...	...	...	...	...	...
1. Didelphys	25	...	25	...	...	...	1	...
2. Chironectes	1	...	1	...	...	...	...	...
	26	...	26	...	...	...	1	...

Deductions

1. The Order of Marsupials consists of about 172 species divided into thirty-nine genera and eight families.

2. Six of these families (with thirty-six genera and 144 species) belong to the Australian Region; the remaining two families (with three genera and twenty-eight species) are Neotropical.

3. Two species of Phalanger have passed the northern boundaries of the Australian Region into Celebes which is in the Oriental Region (see Chapter V., p. 146).

4. In a similar way a single form of Opossum (*Didelphys*) is found in the southern part of the Nearctic Region.

5. With these exceptions no Marsupials are found in the Palæarctic, Nearctic, Oriental, and Ethiopian Regions.

Section VI.—Distribution of Monotremes

The geograpical limits of the fourteenth and last order of mammals may be very easily pointed out, the Monotremes (which are correctly regarded as a sub-class, Prototheria) being absolutely restricted to the Australian Region and found even here only in certain parts of it. The Monotremes in these days are a failing group, consisting only of about five species, which belong to three genera and two families—the *Echidnidæ* or Echidnas, and the *Ornithorhynchidæ* or Duck-bills. *Echidna*, the first-known genus of the former family, is somewhat widely distributed from New Guinea over the whole of Australia and Tasmania. The Papuan, Australian, and Tasmanian forms of *Echidna*, which are closely related,

are classed by some naturalists as species, and by others as sub-species. It is preferable to place them in the former category, as no intermediate forms are certainly known. But in Papua, besides typical *Echidna*, the family is also represented by its larger brother, *Proechidna*, with a single well-known species (*Proechidna bruijni*) and perhaps another species not yet certainly distinguished.

The second family of Monotremes embraces only the excessively anomalous aquatic and fossorial form commonly known as the Duck-bill (*Ornithorhynchus anatinus*). The Duck-bill occurs in Northern Queensland, and spreads southwards thence into New South Wales, Victoria, and South Australia. It is likewise found in Tasmania, but so far as we know has never yet been obtained in any part of Western Australia.

Table of the Order Monotremata, showing the distribution of the species.

	Total.	I. Australian.	II. Neotropical.	III. Ethiopian.	IIIa. Malagasy	IV. Oriental.	V. Nearctic.	VI. Palæarctic.
FAMILY I. ECHIDNIDÆ								
Echidna	3	3	...	...	...	...	...	...
Proechidna	1	1	...	...	...	...	...	...
	4	4	...	...	...	...	...	...
FAMILY II. ORNITHORHYNCHIDÆ.								
Ornithorhynchus	1	1	...	...	...	...	...	...

DEDUCTIONS

1. The Order of Monotremes contains five species referable to three genera and two families.

2. It is entirely restricted to the Australian Region.

Section VII.—Final Conclusions

Thus we see that whether we take the Mammals in Geographical or in Systematic order, we arrive at nearly the same result—namely, that the best Primary Geographical Divisions of the earth are six in number. Of these the Australian Region (*Neogæa*), in which the Mammal-fauna is pre-eminently Marsupial, and embraces the whole Order of Monotremes, is by far the most distinct. It is, however, also easy to separate the Neotropical Region (*Notogæa*), with its one family of Marsupials and numerous Edentates. The remaining Regions (*Arctogæa*), may be grouped together, but are still separable—on more slender grounds, it is true, into four divisions—the Ethiopian Region remarkable for its abundant Ungulates, the Giraffe, and the Hippopotamuses, the Oriental known by its Orangs, Gibbons, and Tapir, and the Palæarctic and Nearctic, which, no doubt, present many points of similarity as regards their Mammal-faunas, but may nevertheless be properly kept apart. The Nearctic Region, as has been shown above, has been overrun by an inroad from the northern portion of the Old World, but has a strongly developed under-stratum of endemic forms mixed up with some Neotropical types, which are utterly foreign to the Palæarctic Region.

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THE END

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